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Macroparasite communities in stray cat populations from urban cities in Peninsular Malaysia

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ABSTRACT

The occurrence of macroparasites was studied from 543 stray cats in four urban cities from the west (Kuala Lumpur), east (Kuantan), north (Georgetown) and south (Malacca) of Peninsular Malaysia from May 2007 to August 2010. Five ectoparasites species were recovered namely, *Ctenocephalides felis*, *Felicola subrostratus*, *Haemaphysalis bispinosa*, *Heterodoxus spiniger* and *Lynxacarus radovskyi*. Two cats from Georgetown were infested with the dog louse, *H. spiniger* and this represented the first host record for this species in Malaysia. Up to nine species of helminths were recovered with overall high prevalences of infection of 83% in Kuantan, followed by 75.1% in Kuala Lumpur, 71.6% in Georgetown and 68% in Malacca. The helminth species comprised five nematodes, *Toxocara malaysiensis*, *Toxocara cati*, *Ancylostoma braziliensis*, *Ancylostoma ceylanicum*, *Physaloptera praeputialis*, two cestodes *Taenia taeniaeformis*, *Dipylidium caninum* and one trematode, *Playtnosomum fastosum*. The majority of helminths were present in the four study sites except for the absence of *P. praeputialis* in Kuala Lumpur. The prevalence and abundance of infections were analysed taking intrinsic (host age and sex) and extrinsic (season) factors into consideration. Levels of infection and infestation were mainly influenced by host age and to a lesser extent sex and season, whereas four nematode species exhibited significant interactions within the intestine of the cat host. The potential for transmission of some macroparasite species from stray cats to the human population in urban areas is discussed.

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1. Introduction

Research on feline parasitic infections from many developed countries have been systematically carried out over the last two decades and highlighted its significant hazards to human health i.e. USA (Schantz, 1999; Hill et al., 2000; Anderson et al., 2003; Cheryl and Dennis, 2003), Australia (Coman, 1972; Wilson-Hanson and Prescott, 1982; Shaw et al., 1983; Thompson et al., 1993; McGlade et al., 2003), and Europe (Lewis, 1927; Christensen et al., 1946; Niak, 1972; Cowper, 1978; McColm and Hutchison, 1980; Nichol et al., 1981; Thienpoint et al., 1981; Stoichev et al., 1982; Engbaek et al., 1984; Van Beeck et al., 1985; Calvete et al., 1998; Barutzki and Schaper, 2003; Coati et al., 2003). In addition several reports of helminth species from feline populations in the Middle East have been published, including Jordan (Morsy et al., 1980), Egypt (Hasslinger et al., 1988) and Qatar (Abu-Madi et al., 2008, 2010). However, each study differs in the range and dominance of helminth species found in local cat populations.

The close association and proximity of stray cats to highly populated and urbanized areas in Peninsular Malaysia prompted the present investigation. Previous regional surveys have provided data on the infection levels of urban cat populations (Rhode, 1962; Amin-Babjee, 1978; Shanta et al., 1980; Shanta, 1982; Sani, 1987; Lee et al.,

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1993) but the diversity, distribution, population patterns and zoonotic significance of cat parasites have hitherto received little attention. Studies on the parasites in stray cats from Peninsular Malaysia by Rhode (1962), Zamirdin et al. (1967), Mustaffa-Babjee (1969), Retnasabapathy and Khoo (1970), Amin-Babjee (1978) and Shanta et al. (1980) have been confined to a small localities with a very few hosts being examined. Furthermore there is no substantial evidence directly implicating stray cats as a source of zoonotic infections in Peninsular Malaysia. The various transmission routes for many cat-borne parasites have yet to be established, whereas the role of strays as carriers and/or reservoirs of infection of medically important parasite species have not been categorically explored. Therefore the present objectives are to investigate the diversity, infection levels and interactions between macroparasites in stray cat populations, relative to host-age, sex and season from four urban cities in Peninsular Malaysia.

2. Materials and methods

2.1. Study sites

Four geographical different sites were selected with Georgetown (5°25′00″ N, 100°19′00″ E), Malacca (2°11′20″N, 102°23′4″ E), Kuantan (3°49′00″ N, 103°20′00″ E) and Kuala Lumpur (3°8′51″ N, 101°41′36″ E) respectively representing the north, south, east and west of Peninsular Malaysia respectively (Fig. 1). All sites were characterized by a tropical climate and high humidity throughout the year with temperatures ranging between 30 °C and 36 °C. Rainfall occurred periodically throughout the year, but some months experienced more rainfall than others. For this purpose, season is divided into wet and dry seasons for each year with dry months falling between January–March and June–September and wet months between April–May and October–December.

2.2. Collection and examination of cats for parasites

Trapping was conducted between May 2007 and August 2010 with the assistance of the municipality of each urban city as part of vector control programmes. Trapping, using sweep nets, was targeted in public areas such as hawker stalls and market places where stray cats frequently forage for food. A small number of cats were provided by animal shelters in the local area namely by the Society for Protection from Cruelty to Animals (SPCA) and the Animal Welfare Society Malaysia (PAWS).

The majority of cats were humanely sacrificed using intravenous injections with Dolethal solution containing 0.5 ml/kg of Pentobarbitone sodium (0.5 ml/kg). SPCA and PAWS sacrificed a small number of cats using chloroform inhalation. Post-mortem examinations were conducted immediately. The study approach was approved by University of Malaya ethical committee reference number ISB/31/1/2013/SNMZ(R). For each cat specimen, the date of trapping, sex, age, body weight and length and the presence and absence of canine teeth were recorded. For age classification, the hosts were categorized into two age groups: adult (≥1.5 kg) and juvenile (<1.5 kg), as described by Sharif et al. (2007).

Stray cats were examined for ectoparasites by examining the external surfaces and collected by thoroughly combing with a fine tooth-comb. For helminth parasites, selected organs, namely the heart, lungs and the alimentary tract and all its offshoots, including the liver, bile ducts and pancreas, were removed, placed in 1% NaCl solution and examined for parasites under a dissecting microscope. The microhabitat of each parasite was promptly recorded and all parasites were collected, counted and preserved in 70% alcohol. Specimens of ectoparasites and nematodes were cleared and mounted in polyvinyl lactophenol solution on a clean glass slide for identification. Trematodes and cestodes were stained overnight in paracarmine, dehydrated in ethanol, cleared in methyl salicylate and mounted in Canada balsam. Slides were oven-dried before being sealed and appropriately labeled. Ectoparasites identification to species level was done with reference to Pictorial Keys to Arthropods, Reptiles, Birds and Mammals of Public Health Significance (USA Department of Health, 1969) and keys by Kohls (1957) and Price & Graham (1997). All nematodes were identified using the CIH Keys (Anderson et al., 1980) while, trematodes and cestodes were identified with reference to Soulsby (1968).

2.3. Data analysis

Parasite species richness was analysed using the Simpson's diversity index, whereas the prevalence and abundance of infection ± standard error of the mean (SEM) of each parasite species were defined after Margolis et al. (1982). Parasite burdens were expressed as geometric means (GM) ± 95% confidence limits (CL). Univariate analysis of prevalence and abundance data, relative to intrinsic (host age and sex) and extrinsic (season) factors were undertaken using the General Linear Model (GLIM) as previously described by Abu-Madi et al. (2005).

The frequency distribution of parasites was tested for goodness of fit to the negative binomial using a reformulated method of measuring the k parameter (Pal and Lewis, 2004). Interactions between intestinal parasite species, based on abundance values, were evaluated using the bivariate Pearson's product-moment correlation coefficient (cc).

3. Results

3.1. Cat population

Up to 543 stray cats were collected from 4 localities representing the west (Kuala Lumpur, $n = 241$), east (Kuantan, $n = 100$), north (Georgetown, $n = 102$) and south (Malacca, $n = 100$) states of Peninsular Malaysia. The total number of females ($n = 343$ cats) outnumbered males ($n = 200$ cats) of which 57.8% were adults ($n = 314$, $n = 107$ males and $n = 207$ females) and 42.2% were juveniles ($n = 229$, $n = 93$ males and $n = 136$ females). Three hundred and seventy cats were captured during the dry compared with 173 cats during the

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