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Occurrence of filaria in domestic dogs of Samburu pastoralists in Northern Kenya and its associations with canine distemper

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ABSTRACT

Samples of blood (serum, smears and blood preserved with ethanol) were collected from dogs during a vaccination campaign in northern Kenya in the years 2006 and 2007. Blood was screened for filarial parasites using molecular and microscopy methods and sera were tested for antibodies against canine distemper virus (CDV). Parasitological examination revealed the presence of two species of canine filariae: *Acanthocheilonema dracunculoides* and *A. reconditum*. The DNA from the former species was detected in 58% dogs sampled in 2006 and 36% dogs sampled in 2007, whereas the latter was found only in 4.2% samples collected in 2007. Microfilariae were found in 33.8% blood smears collected in 2006 and 10.6% blood smears collected in 2007. The seroprevalence of CDV was 33.4% in 2006 and 11.2% in 2007. The effect of sex, age and CDV-seropositivity/seronegativity on the occurrence of *A. dracunculoides* was evaluated. Infection by *A. dracunculoides* was more common in males and in dogs with a positive antibody titer for canine distemper, but evenly distributed among different age groups. The difference in the prevalence of *A. dracunculoides* in two isolated mountain ranges was not statistically significant. Methodologies available for detection and determination of canine filariae are compared, underlining methodical pitfalls arising through the determination of less common filarial species. The role of single epidemiological factors and possible association between canine distemper and filariasis are discussed.

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Abbreviations: ALRMP, Arid Land Resource Management Project; CNLI, Continental New Life International; CDV, canine distemper virus; pM, pmol; RFLP, restriction fragment length polymorphism; SHADE, Samburu Health Advancement, Diagnosis and Education; WHO, World Health Organization.

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1. Introduction

There are several species from the family Onchocercidae occurring as vector-borne pathogens in carnivore populations worldwide. In recent years, considerable attention has been given to the genus *Dirofilaria*, especially the causative agent of canine heartworm disease, *D. immitis* (Leidy, 1856). The biology of the genera *Acanthocheilonema* (formerly *Dipetalonema*), *Onchocerca* and *Brugia* remains obscure despite their significant prevalence in certain regions (Snowden and Hammerberg, 1989; Genchi et al., 2005; Sréter and Széll, 2008).

Acanthocheilonema dracunculoides (Cobbold, 1870) and *A. reconditum* (Grassi, 1890) are widespread in East Africa, in patterns corresponding to the occurrence of their vectors and favorable climatic conditions (Nelson et al., 1962; Lightner and Reardon, 1983). Adults of *A. dracunculoides* develop in the thoracic cavity and on the greater omentum of dogs. Ticks (family Ixodidae) or louse-flies (family Hippoboscidae) are believed to transmit microfilariae (Nelson, 1963; Olmeda-Garcia et al., 1994). *A. reconditum* can be found in the subcutis of hosts and is transmitted by fleas and chewing lice (Zajac and Conboy, 2006). Both *A. dracunculoides* and *A. reconditum* are generally considered non-pathogenic for dogs, yet are capable of causing skin lesions, body cavity effusions and even neurological symptoms, depending on the abundance and localization of adults (Bolio et al., 2002). Both species should be considered within differential diagnosis of microfilariaemia in dogs. *A. dracunculoides* is of special importance because of its close morphological similarity of its microfilariae to those of highly pathogenic *D. immitis* (Schrey and Trautvetter, 1998). Discrimination of microfilariae to the species level by molecular tools is considered far more specific than use of microscopy, especially when dealing with less-known filarial species (Rishniw et al., 2006; Furtado et al., 2009).

In recent years, many studies focused on the host immune mechanisms induced by filarial nematodes, since its understanding is assumed to be necessary for the elimination of human lymphatic filariasis (Ravindran et al., 2003; Duerr et al., 2008). Interactions between filaria and other infectious agents are also broadly discussed, especially concerning the co-infection of human lymphatic filariasis and HIV (Bundy et al., 2000; Brown et al., 2006; Nielsen et al., 2007). Since both diseases are immunosuppressive, it was suggested that acquisition of one can predispose the host for the other (Nielsen et al., 2007). Among dog populations, analogous interactions can be expected between filariasis and canine distemper, perhaps serving as an epidemiological model.

The canine distemper virus (CDV) (genus *Morbillivirus*, family Paramyxoviridae) occurs worldwide and is pathogenic for a range of carnivores. It replicates in macrophages and lymphocytes of the host, leading to lymphopenia, loss of the delayed-type hypersensitivity response and suppression of lymphoproliferation (Schobesberger et al., 2005). Long lasting immunologic abnormalities are present even after clearance of the virus from peripheral leukocytes in convalescent dogs (Beineke et al., 2009). There is no doubt about the substantial direct impingement of CDV on carnivore populations (Cleaveland et al., 2000). Yet the impact of CDV-induced immunosuppression on the epidemiology of other diseases remains an area to be explored (Munson et al., 2008).

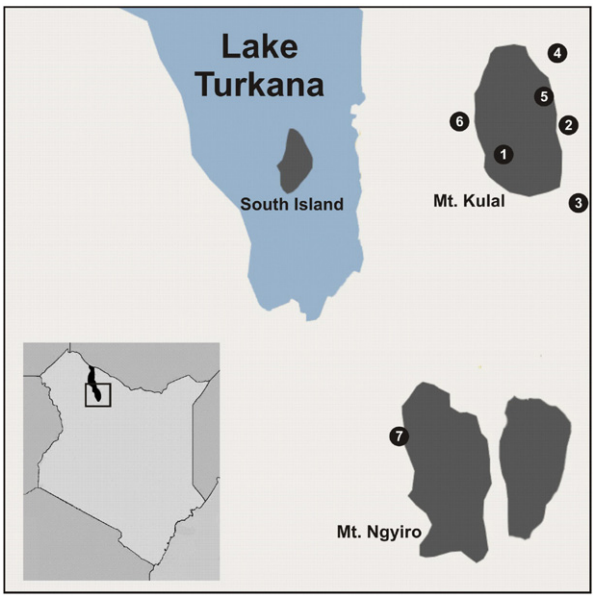

Fig. 1. Sampled localities: (1) Gatab, (2) Olturot, (3)Makutano, (4) Arapal, (5) Kororoi, (6) Larachi, and (7) Tuum.

The principal aim of this study was to describe the spectrum and prevalence of filarial nematodes in dogs living on two isolated mountain ranges in Northern Kenya. For its considerable prevalence on the study site, special emphasis was given to *A. dracunculoides*. We discuss the challenging features of determination of this species, far less known than its pathogenic counterpart, *Dirofilaria immitis*. We compare the prevalence of *A. dracunculoides* in males and females, different age groups and two sampled localities. Besides, we address whether the prevalence of this parasite is associated with canine distemper virus, also highly prevalent in the area.

2. Materials and methods

2.1. Study area

Blood samples of dogs were collected during two antirabies vaccination campaigns on Mt. Kulal and Mt. Ngyiro. Both mountain ranges are situated close to the southern tip of Lake Turkana in the Rift Valley and Eastern provinces of Kenya. The lowlands of the Turkana land region are semiarid, covered by a mosaic of *Acacia-Commiphora* bushland, while the peaks of the mountain ranges are covered with mountain mist forest dominated by *Juniperus procera* and *Olea africana*. The lake is 410 m above sea level, whereas the summit of Mt. Kulal reaches up to 2335 m and Mt. Ngyiro to 2752 m. The campaign was held in seven villages; six on Mt. Kulal and one on Mt. Ngyiro (Table 1 and Fig. 1). Both areas are inhabited by pastoralists, mainly of the tribes Samburu and Turkana. Dogs are kept to guard the herds and their population is characterized by an accelerated turnover rate and sex-ratio bias towards

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