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AFRICAN WILD DOGS (*LYCAON PICTUS*) ENDANGERED BY A CANINE DISTEMPER EPIZOOTIC AMONG DOMESTIC DOGS NEAR THE MASAI MARA NATIONAL RESERVE, KENYA

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ABSTRACT: A longitudinal study of canine distemper (CD) among domestic dogs on Maasai communal land to the north of the Masai Mara National Reserve in Kenya was conducted from 1989 to 1991. Prevalence of antibodies to CD was very low among domestic dogs in 1989 and 1990 (4%, $n = 49$; and 1%, $n = 119$, respectively) and no African wild dogs (*Lycaon pictus*; $n = 16$) collected simultaneously from the same area had detectable antibodies. Among 51 domestic dogs sampled in 1991, however, prevalence of CD antibodies rose significantly ($P < 0.01$) to 76%. Disease-related mortality rates among domestic dogs were estimated from 1990 to 1992; they rose significantly ($P < 0.01$) from 21% in 1990 to 50% in 1991 and then decreased significantly ($P < 0.01$) to 38% in 1992. The 1992 mortality rate remained significantly ($P < 0.01$) higher than that of 1990. Signs observed in clinically ill domestic dogs were consistent with CD and included listlessness, decreased appetite, bilateral serous to mucopurulent oculonasal discharge, and diarrhea. No carcasses could be retrieved for virus isolation and postmortem examination. Concurrent with this CD epizootic in domestic dogs, the known African wild dog packs in this region disappeared.

Key words: African wild dog, *Lycaon pictus*, domestic dog, canine distemper, serology, surveillance.

INTRODUCTION

Canine distemper (CD) is a contagious viral disease encountered worldwide, and is characterized by high mortality in dogs and other carnivores (Appel and Gillespie, 1972). Eight of the 11 families of carnivores including the Ailuridae, Ailuropodidae, Canidae, Hyaenidae, Mustelidae, Procyonidae, Viverridae and Felidae have been reported to be susceptible to CD (Montali et al., 1987). The disease is transmitted readily between susceptible species, but domestic dogs remain a primary reservoir for the virus (Gorham, 1966). The natural history of CD in free-ranging carnivores has not been studied adequately, but CD epizootics have been reported in free-ranging populations of black-footed ferrets (*Mustela nigripes*) (Williams et al., 1988), raccoons (*Procyon lotor*) (Robinson et al., 1957), raccoon dogs (*Nyctereutes procyonoides*) (Machida et al., 1993), skunks (*Mephitis mephitis*) (Hemboldt and Jungherr, 1955), and gray foxes (*Urocyon cinereoargenteus*) (Hoff and Bigler, 1974). Canine distemper recently was cited as the major source of mortality (78%) among gray foxes in the southeastern United States (Davidson et al., 1992), and Roscoe (1993) proposed an enzootic status for the disease among New Jersey (USA) raccoons. In addition, significant epizootics have occurred among carnivores in zoos (Sedgewick and Young, 1968) and on fur farms (Parker et al., 1961). Canine distemper vaccine-related mortality has been reported for African wild dogs (*Lycaon pictus*) (McCormick, 1983), black-footed ferrets (Carpenter et al., 1976), kinkajous (*Potos flavus*) (Kazakos et al., 1981), and red pandas (*Ailurus fulgens*) (Montali et al., 1983).

Canine distemper is transmitted mainly through inhalation of airborne virus (Appel, 1987). Between 7 and 14 days of postexposure, depending on virus strain, domestic dogs may develop a humoral and cellular immune response and recover. Failing this, the animal either will die of acute or subacute disease or become persistently infected. Dogs with acute infection begin to shed the virus approximately

7 days post-exposure in all body secretions. Virus can be excreted from 60 to 90 days post-exposure. The virus only survives for a matter of hours in the environment (Appel, 1987).

Our objective was to describe a CD epizootic that occurred among domestic dogs in 1991 in an area just north of the Masai Mara National Reserve in Kenya. This region is characterized by a high density of wildlife species living in an area populated by the Maasai tribe and their domestic animals. These include a large number of domestic dogs, most of which are unvaccinated. Domestic dogs are kept primarily to guard livestock from predators. Based on interviews with owners, domestic dogs have varying levels of contact with wild relatives including jackals (*Canis mesomelas*), bat-eared foxes (*Otocyon megalotis*) and African wild dogs. Therefore, disease epizootics among domestic dog populations could potentially have a significant impact on susceptible sympatric wild canid species. Such epizootics are especially worrisome for the conservation of the endangered African wild dog, which has experienced population declines throughout its geographic range during the past 20 yr (Fuller and Kat, 1990).

MATERIALS AND METHODS

Domestic dogs in the Masai Mara live in association with the Maasai tribe in family compounds, referred to as manyattas. Study manyattas within an approximately 800 km² study area (35°12'E, 1°13'S) were randomly selected (Alexander et al., 1993a). This area was selected to overlap the home ranges of African wild dogs (Fuller and Kat, 1990). In 1989, 1990 and 1991, dogs in 21, 33, and 27 manyattas, respectively, were sampled. The number of manyattas varied between years as family groups split or merged. In addition, some owners declined sampling due to anxiety concerning the effects of blood collection on the health of their dogs.

All domestic dogs that could be captured in a selected manyatta were sampled (1989, n = 49; 1990, n = 119; 1991, n = 51). Numbers of dogs sampled varied by year according to the number of dogs present at the time and our ability to catch animals for sampling purposes. No domestic dogs were sampled for this study in 1992, but mortality analyses were conducted. Adult dogs (≥6 mo old as determined by the presence of permanent canines) were sampled during July and August of each consecutive year. Attempts were made in 1989 and 1990 to identify study animals by ear tags. However, both plastic and metal ear tags were removed from dogs by Maasai children. The loose association of domestic dogs with humans made cohort identification by owners difficult; therefore, the sampling strategy consisted of re-sampling identified manyattas rather than individual dogs. Animals sampled had no known history of vaccination for CD.

Sixteen African wild dogs in five radio-collared groups were sampled in 1989 and 1990 from this same region. Wild dogs were sampled mainly during June to September. Animals were immobilized by remote injection with 2–3 mg/kg Telazol® (A. H. Robbins Company, Richmond, Virginia, USA). Anesthesia was maintained for approximately 35 to 55 min, and individuals usually returned to their packs within 2 hr. Ground and aerial telemetry was used to monitor wild dogs (Fuller and Kat, 1990). Tour operators in the area were asked to report sightings of wild dogs and other wild canids.

Blood was collected via the cephalic vein from African wild dogs and domestic dogs. Serum samples were stored at −20 C and tested within 1 yr of collection. Serum antibodies to canine distemper were measured using a microneutralization test with log titers >1.0 considered a positive reaction (Appel and Robson, 1973). One African wild dog was tested for rabies at the National Veterinary Research Center, Kenya, through a direct fluorescent antibody test (Dean and Abelseth, 1973).

An elder Maasai tribesperson was selected each year from each study manyatta to answer a prepared questionnaire in 1990 (n = 33), 1991 (n = 27), and 1992 (n = 35). A Maasai interpreter, fluent in both English and the tribal language, Maa, was used to ensure accurate communication. Mortality rates used in this paper then were calculated from questionnaires as disease related mortality divided by the total number of dogs. The total number of dogs was defined as the number of dogs present in the manyatta during the last year. Disease related mortality was defined as the total number of dog deaths that occurred in the last year associated with perceived illness separate from deaths associated with injury. Thus, this number represented nonspecific disease related mortality and did not exclude the effect of diseases other than CD on calculated mortality rates. All age classes of dogs were included in these calculations. No mortality information was gathered for 1989. Pro-

portions of seropositive animals and mortality rates among years were compared by Yates corrected chi square test and 95% confidence intervals (ci) was calculated for prevalences (Martin et al., 1987).

RESULTS

The antibody prevalence to CD in domestic dogs sampled was 4%, (n = 49, 95% confidence interval [ci] = 0 to 10%); 1%, (n = 119, ci = 0 to 2%); and 75%, (n = 51, ci = 63 to 86%) in 1989, 1990, and 1991, respectively (Fig. 1). Antibody prevalences were significantly higher ($P < 0.01$) in 1991 than in 1989 and 1990. All African wild dogs sampled in 1989 (n = 12) and 1990 (n = 4) were negative. Disease-related mortality rates for domestic dogs for 1990 to 1992 were 21% (n = 200, ci = 15 to 26%); 50%, (n = 239, ci = 43 to 57%); and 38% (n = 483, ci = 33 to 42%), respectively. Mortality rates for 1990 and 1992 were significantly different ($P < 0.01$) from those of 1991. The 1992 disease related mortality rate remained significantly higher ($P < 0.01$) than that of 1990.

Maasai owners reported that their domestic dogs began to die during the long dry season (December 1990 to May 1991). In 1991, sampled animals were given a routine physical exam. Unfortunately, no carcasses could be retrieved for virus isolation and postmortem examination due to a lack of personnel in the field and intense scavenging by vultures and hyenas.

In 1990, only two groups of African wild dogs, the Intrepids and Olesere packs, remained in the area. In late December 1990, several tour drivers reported sightings of dead and dying wild dogs from the Intrepids pack. No carcasses were found, and the collar from the only radiocollared animal was discovered with its strap cut. Although wild dogs were individually known, no other animals from the pack were ever located. One African wild dog carcass from the Olesere pack was retrieved on 2 January 1991; it was positive for rabies through a direct fluorescent antibody test. As the carcass was in an advanced state of decomposition, distemper testing could not be performed, and confirmation of the rabies diagnosis could not be made by another laboratory. The other radiocollared animal from the Olesere pack was never found.

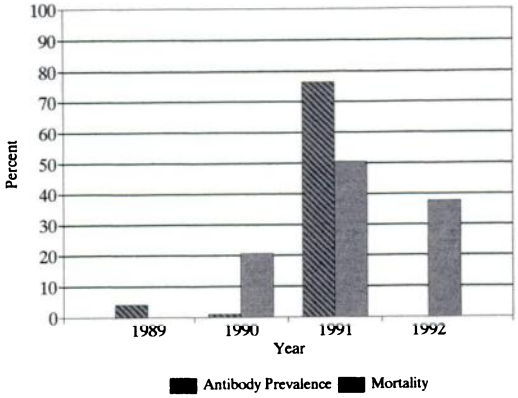

FIGURE 1. Prevalence of antibodies to canine distemper virus (1989 to 1991) and disease related mortality (1990 to 1992) among domestic dogs in the Masai Mara, Kenya. Sample sizes for serologic studies performed from 1989, 1990, and 1991 were 49, 119, and 51 respectively. Sample sizes for mortality estimates calculated for 1990, 1991, and 1992 were 200, 239, and 483 respectively.

DISCUSSION

Based on serologic results from both Kenyan domestic dogs and African wild dogs, we believe that an epizootic of CD occurred in which the virus apparently was introduced into naive populations of African canids. All African wild dogs sampled in 1989 and 1990 were seronegative. Antibody prevalence levels of CD in domestic dogs sampled rose from 1% in 1990 to 76% in 1991. Disease related mortality rates among domestic dogs rose significantly from 21% during 1990 to 50% in 1991. Clinically ill individuals (n = 11) exhibited signs consistent with CD including listlessness, decreased appetite, bilateral serous to mucropurulent oculonasal discharge and diarrhea (Gorham, 1960).

Canine distemper epizootics appear to occur approximately once every 5 yr in Nairobi and Mombasa in Kenya (Alexander, unpubl.). These urban regions support

the largest concentrations of domestic dogs. The last CD epizootic in Nairobi occurred in 1990 (Alexander, unpubl.) and we speculate that it may then have spread into the Masai Mara region with a resultant epizootic in the resident domestic dog population. Epizootics have been reported to occur in isolated areas where the disease was absent for several years and a highly susceptible dog population had emerged (Greene and Appel, 1990). Similar epizootics may be seen in wildlife populations (Appel and Gillespie, 1972). In susceptible and isolated populations of dogs such as this, the disease is severe and widespread, affecting all age groups (Gorham, 1960).

Of all the viral diseases, CD appears to have the most serious consequences for susceptible free-living and captive carnivores (Montali et al., 1987). The effect of the epizootic on susceptible wild carnivore populations living in the study site is unknown. However, observations made by tour drivers in the area suggest that sightings of jackals and bat-eared foxes declined during 1991 when the domestic dogs began to die. Sightings of these canids by the research team also declined in areas known to have jackals and bat-eared foxes. The disappearance of the remaining African wild dogs occurred during this same period.

It is impossible to determine retrospectively if any causal relationship existed between the apparent decline in wild canid populations and the CD epizootic among sympatric domestic dogs in the region. Furthermore, it is not known to what degree rabies, which was endemic in the area, contributed to mortality among canids (Alexander et al., 1993b). Our findings, however, illustrate the importance of monitoring populations of domestic animals that are in close contact with endangered relatives. Such information may often provide important insights for the formulation of informed management plans for endangered species, and consideration should be given to the threats of domestic animal diseases when developing conservation programs. With growth of human populations in Africa, contact between domestic and wild animals is likely to increase, and disease surveillance among sentinel species is recommended.

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