Survey of antibodies to feline viruses in free-ranging lions

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Blood samples (n = 32) collected from free-ranging lions *Panthera leo* in the Kruger National Park were examined for the presence of antibodies to feline viruses. An indirect immunofluorescent antibody test was developed for this purpose and the organisms surveyed included feline panleukopenia, herpes, calici, and corona viruses. Twenty-seven lions (84%) had antibodies to panleukopenia virus, 29 (91%) had antibodies to herpes virus while all 32 animals were negative for antibodies to calici and corona viruses. This is the first record of evidence for the occurrence of feline panleukopenia infection in free-ranging non-domestic Felidae.

Bloedmonsters (n = 32) van vrylewende leeus *Panthera leo* in die Nasionale Krugerwildtuin is vir die teenwoordigheid van teenliggampies teen virusse van katte ondersoek. 'n Indirekte immunofluoressensie-teenliggaamtoets is vir hierdie doel ontwikkel en die organismes wat ondersoek is het die volgende ingesluit; panleukopenie, herpes, calici en coronavirus van katte. Sewe-en-twintig leeus (84%) het teenliggame teen panleukopenievirus gehad, 29 (91%) het teenliggame teen herpesvirus gehad terwyl all 32 diere negatief was vir teenliggame teen calici en coronavirus. Hierdie is die eerste bewys van die voorkoms van panleukopenie-infeksie van katte in vrylewende wilde Felidae.

Key words: Lions, *Panthera leo*, feline panleukopenia, herpes, calici and corona viruses, antibodies, IFA

Introduction

Non-domestic felids are susceptible to many of the same diseases that affect domestic cats. Non-domestic felids are unique in their dietary and environmental requirements, and in their relative isolation from diseases that may be ubiquitous in domestic cat populations. These factors are important when considering the epidemiology of common diseases in non-domestic felids (Quesenberry 1984).

Feline panleukopenia virus (FPLV) has been well characterized as a small single stranded DNA virus and a member of the Parvo virus family (Povey & Davis 1977). There is only one known serotype (Gaskell 1985) and viruses isolated from non-domestic species have been found to be indistinguishable from that infecting the domestic cat (Johnson 1965; Studdert, Kelley & Harrigan 1973).

FPLV has been reported in many species of non-domestic felids; leopards *Panthera pardus* (Johnson 1964), lions *Panthera leo* (Studdert *et al.* 1973), tigers *Panthera tigra* (Povey & Davis 1977), cheetahs *Acinonyx jubatus* and others (Wallach & Boever 1983). In fact the virus was first cultivated from a leopard (Johnson 1964).

Feline panleukopenia disease has been reported in captive non-domestic felids but to date has not been reported to occur in free-living felids (Montali, Bartz & Bush 1987).

Feline herpes virus (FHV) Type 1 is a worldwide infection of cats. Apparently healthy carrier cats or cats with clinical disease are the principal sources of infection (Pedersen 1987). Confirmed cases of feline herpes in wild carnivores are few. Diagnosis, based on clinical signs, has been made in cheetahs, gold cats *Felis temmincki*, servals *F. serval* and bobcats *F. rufus* (Povey & Davis 1977). The relative isolation of non-domestic felids in parks probably masks the true epidemiology of the disease in these species (Bartz & Montali 1987a).

Feline calici virus (FCV) has been isolated worldwide during studies on naturally occurring outbreaks of upper respiratory disease in cats (Pedersen 1987). The virus exists as a single serotype with several dozen strains (Gillespie & Scott 1973) and there is a lack of cross protection between vaccine strains and some isolates (Pedersen, Laliberte & Ekman 1983). There are no reports of FCV virus disease in free ranging non-domestic felids. Disease has, however, occurred in captive cheetahs (Sabine & Hyne 1970).

Feline infectious peritonitis (FIP) is a contagious highly fatal corona virus disease of Felidae. Recent sero-epidemiologic surveys have demonstrated that infection with feline corona viruses is prevalent in 20–30% of domestic cats in the general population worldwide and in multi-cat households this rate may even be as high as 100% (Weiss 1978). The disease has been recognized in Europe, North America, Australia, Japan, and South Africa (Pedersen 1983). The natural host range of FIP virus (FIPV) includes domestic and non-domestic felids such as cheetahs, lions, servals, caracals *Felis caracal* and leopards (Appel 1987; Colly 1973; Evermann, Burns, Roelke, McKeirnan, Greenlee, Ward & Pfeifer 1983; Pfeifer, Evermann, Roelke, Gallina, Ott & McKeirnan 1983; Van Rensburg & Silkstone 1984).

Subclinical corona virus infection (Horzinek & Osterhaus 1979) as well as epidemics of FIP (Evermann *et al.* 1983; Pfeifer *et al.* 1983) have been reported in captive cheetah populations. There is no record to date of there being clinical disease in free-ranging populations.

Reports of the above virus diseases in free-ranging non-domestic felids are uncommon. This article reports on a serosurvey for antibodies to feline panleukopenia, herpes, calici and corona viruses in order to obtain evidence for presence, or lack of, these viruses in free-ranging lions in the Kruger National Park, South Africa.

For the purpose of antibody detection, an indirect immunofluorescent antibody (IFA) test was developed.

Materials and Methods

Lions

Free-ranging lions (n = 32) were bled during 1987 to 1990. Blood samples were collected into plain tubes, allowed to clot and the serum removed. The serum samples were then stored frozen at -20°C until used.

IFA

An indirect immunofluorescent antibody test using Norden Laboratories feline kidney (NLFK) cells infected with field isolates of FPLV, FHV, FCV and corona viruses fixed onto multi-well test slides, was used to detect the presence of antibodies in the serum samples of the lions. Monolayers of virus-infected cells were harvested by trypsinization when about 40% of the cells showed cytopathic changes. As panleukopenia shows no cytopathic changes, these cells were harvested five days post infection. The cells were washed three times with phospate buffered saline (PBS), mixed with equal amounts of uninfected cells and air dried on to the slides (3×10^3 cells per well). The slides were fixed in chilled acetone for 10 min, dried and stored frozen until used. The cells were covered with 20 µl volumes of a 1 : 10 serum dilution. The positive control consisted of serum from a hyper-immune cat and gave a 3+ reaction at a 1 : 100 dilution to all the viruses tested. The slides were incubated for 1 h at 37°C in a humid chamber and subsequently washed three times in PBS and once in distilled water. After air drying, 20 µl volumes of a 1 : 50 dilution of fluorescein isothiocyanate (FITC) labelled sheep anti-cat IgG (Serotec, Oxford, England) were applied to the cells. The slides were incubated, washed and dried as before and mounted in buffered glycerol (pH 7,8). The cells were examined for specific reactivity using a fluorescence microscope.

Results

Twenty-seven (84%) of the lions had antibody levels to FPLV. Twenty-nine (91%) had antibodies to FHV. None of the animals had antibodies to either FCV or corona viruses.

Discussion

Montali *et al.* (1987) state that feline panleukopenia does not appear to occur in free-living felids. This is in direct contrast to the results obtained above. The impact of this disease on the ecology of the lion population in the Kruger National Park is unknown. As scavengers would remove any carcasses, death owing to panleukopenia could not be verified. However, if there were an outbreak, the decrease in population would be noted. As there has been no unexplained decrease in lion numbers, one must assume that the presence of FPLV does not pose a threat to this population group.

FHV virus appears to be slightly more widespread than FPLV. This virus has also been isolated from free-ranging cheetahs by Thompson, Sabine & Hyne (1971). Herpes virus requires a carrier state for its survival and transmission would be easily facilitated by the mutual grooming between members of the pride. As this virus is not lethal, populations would not be affected by its presence. Possible detrimental effects could be abortions or fading kitten syndrome. As cub losses could be the result of other factors such as predation, it is difficult to estimate the role played by FHV in cub mortality. This requires further investigtion in order to elucidate the true role played by herpes viruses in population dynamics.

The natural fragility of calici virus makes persistent carrier-state infections obligatory for the survival of the virus (Bartz & Montali 1987). Owing to the lack of antibodies, one can assume that there are no carriers of this infection in the present study group. The same argument would be applied to feline corona viruses.

The above study has shown the presence of feline panleukopenia and herpes viruses in lions of the Kruger National Park. The origin of these infections could have been domestic cats brought into the park approximately four years ago. Unfortunately, the lions were not tested prior to this and therefore the origins of these viruses remain unknown.

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