THE SIGNIFICANCE OF INFECTIOUS DISEASES IN AFRICAN GAME POPULATIONS

E. YOUNG

Division of Veterinary Services, Kruger National Park

INTRODUCTION

The tendency in wild animal species to manifest few or no recognisable and identifiable signs of disease, the rapid deterioration of game animals which have succumbed to certain infections, and the efficient detection and removal of carcasses by scavengers have led to the impression that wild game populations are not frequently decimated by disease. It is the intention with this paper to stress the significance or potential danger of infectious diseases to our natural fauna. Infectious diseases and metazoon parasites can play an important role in the regulation of game population levels and anyone engaged in a study of population kinetics should endeavour to acquaint himself with a knowledge of the prevalence and potential effects of infectious diseases in the studied area.

It must be pointed out that this paper should not be considered to be a complete summary of the effects of African game diseases as it is only possible here, in view of lack of time and space, to briefly discuss a few examples of infectious diseases of wild animal species.

DISCUSSION

The successful propagation of any infection in an animal population is controlled by various factors, including the virulence of the infectious agents involved, the susceptibility of the host animals and the successful transmission of the pathogen from one individual to another. The same disease condition may therefore have a varying impact on a particular species of host animal. It is however, convenient to classify the infectious diseases of game animals, on the basis of their mode of action and general importance, into four main groups, i.e., dramatic, erosive, complementary and asymptomatic infections.

(*a*) *Dramatic diseases.* This group of diseases manifests dramatic mortality amongst susceptible game species. Rinderpest and anthrax may be considered as the best examples of this group of diseases as both threaten directly the existence of especially the ungulates of this continent. Anthrax is known to have killed more than a thousand wild mammals in the short period of 4 months in the northern part of the Kruger National Park (Pienaar 1961 and 1967). In the same Park, rinderpest almost exterminated certain wild animal species in a massive outbreak in the late nineties (Stevenson-Hamilton 1912, 1929 and 1947). In 1960 rinderpest swept down from the northern districts of Kenya and also decimated buffalo and other ungulate game herds in that country (Beaton 1963). Talbot, quoted by Plowright (1963) has estimated that about 85% of the annual wildebeest calf crop in the Serengeti

Park, Tanzania, may be lost in the first year of life, a large part of which being accounted for by the so-called yearling disease. Rinderpest, being present in an enzootic form in this country, subsequently appeared to be chiefly responsible for this yearling mortality.

Complement fixing antibodies against Rift Valley fever were demonstrated in serum specimens of several hippopotami (Howell 1965) and one African elephant (*Loxodonta africana*) of the Kruger Park. Weiss (1957) mentioned that mortality and abortions had been reported in many wild buck in the epizootic area during the 1951 outbreak of this virus disease in South Africa. The importance of this disease as a mortality factor of wild animals in the Kruger Park is still relatively unknown at this stage but further research is in progress and we hope to learn more about it in the near future.

Serological tests also demonstrated blue-tongue antibodies in serum specimens of wild Cape buffalo, *Syncerus caffer*, and subsequent experimental work proved the susceptibility of the buffalo to this important sheep disease. Three buffalo calves, which had been innoculated with a relatively mild strain of blue-tongue not only developed the typical mouth lesions of the disease but one of them even became paralysed and died as a result of the infection (Young and Howell 1966). These findings were unexpected as blue-tongue virus has not yet been found to cause pathological lesions in cattle. Blue-tongue can be responsible for high mortality in domestic sheep and our preliminary results suggest that this disease may also be of practical importance in free-living buffaloes.

Lumpy skin disease, which may be considered to be a dramatic infection of susceptible cattle, has also recently been proved to be infectious for two species of wild mammals. A young giraffe, *Giraffa camelopardalis* and impala, *Aepyceros melampus*, which had been inoculated with the Neethling strain of lumpy skin disease virus, developed the typical lesions of the disease and died from the infection. A second impala lamb, inoculated with emulsified lesion material from the first impala reacted in the same way and also died (Young, Weiss and Basson 1967). In South Africa game animals often intermingle with infected cattle and I believe that natural cases of lumpy skin disease will be proved to be also responsible for mortality in wild ungulates. The course of the experimentally induced infection was quite rapid in the giraffe and impala and it seems possible that untreated wild animals could die in a very early stage of the infection, before the clinical recognition of lumpy skin disease becomes possible.

Horse-sickness antibodies were detected in a serum specimen from a single Burchells zebra, *Equus burchelli*. Further experimental work will be undertaken in order to study the pathogenesis of this highly fatal disease of horses in zebras.

Epizootics of certain infectious diseases may also be responsible for high mortality in wild carnivores. Feline infectious panleucopaenia or cat flu may, for instance, follow a rapid and highly fatal course amongst some of the wild feline species (Hofmeyr 1956) and canine rickettsiosis was suspected to be responsible for the great reduction in numbers of wild dogs in the southern part of the Kruger National Park (Neitz and Thomas 1938).

Canine distemper was diagnosed in the Cape hunting dog, silver jackal and bat-eared fox in the Pretoria Zoo (Hofmeyr 1956). This virus disease can cause high mortality amongst domestic dogs and the fact that the above mentioned animals succumbed to the infection

suggests that canine distemper may also play some part in the natural reduction of numbers of susceptible species of wild carnivores.

It was found, from serological surveys, that distemper viruses are more likely to occur in areas with high fox-population indices (Parker, Cabaso, Dean and Chaetum 1961). This phenomenon may also apply to other infections in other species and reminds one of the decline in the numbers of Cape hunting dogs in the Kruger Park (see above), followed by apparently normal breeding seasons and a gradual increase in numbers. The habit of these animals to hunt over extensive areas and to congregate in large numbers when they breed in the mountains in the Malelane section of the Kruger National Park, presents extremely favourable conditions for the development of epizootics. It may be expected that the effects of the infectious diseases mentioned above may be quite drastic when large numbers of highly susceptible animals become infected.

Pasteurella pestis, the aetiological agent of plague can have a very drastic effect on wild rodent populations (Davis 1953) and certain wild rodent species may also be killed by Rift Valley fever (Weiss 1957).

Wild bird species may be decimated by infections such as psittacosis and Newcastle disease. The latter is highly infectious and fatal for domestic poultry and was described in captive specimens of the ostrich and white-backed vulture (Kauker and Siegert 1957). Kaschula (1950) also proved its infectivity for the Cape francolin and Cape sparrow.

(*b*) *Erosive diseases.* These are usually smouldering infections which rarely cause dramatic mortality. They often exert a continuous decimating effect and one can expect that prolonged, detailed analyses of mortality factors may indicate that in many parks of Africa more animals are killed by erosive diseases than by the more dramatic group of infections. This group of diseases may either be established in an enzootic form in a particular region or be responsible for mortality in sporadic cases which have accidentally come in contact with other infected game animals, domestic stock or even humans. Some of the dramatic diseases discussed above may also, under certain circumstances, become endemic in an area and then exert an erosive rather than an explosive effect in resistant game populations.

Instead of repeating information from well-known published work, I prefer to quote a few recent and some unpublished findings as examples of this group of infections in wild animals.

Actinomycosis is a chronic suppurative and granulomatous disease of domestic stock, caused by *Actinomyces bovis*. Jaw lesions, resembling those of actinomycosis in the domestic ox were found in the impala (de Vos 1967), bushbuck, *Tragelaphus scriptus*, Thomson's gazelle, *Gazella thomsoni*, and a few species of exotic mammals in the Pretoria Zoo, including the Himalayan tahr, *Hemitragus jemlahicus*, and Indian nilgai, *Boselaphus tragocamelus*. In spite of extensive involvement of the mandibles of some of these animals, their general condition did not seem to be adversely affected. It may however be imagined that more advanced lesions may cause infected animals to die from starvation.

Intermandibular abscesses which had been responsible for the death of two young mountain reedbuck, *Redunca fulvorufula*, yielded cultures of *Staphylococcus aureus* upon

bacteriological examination (Cameron 1965). These bacteria are frequently associated with purulent conditions in domestic animals and man.

Abscesses, resembling those caused by *Corynebacterium pseudotuberculosis*, continuously developed in captive Thomson's gazelles at the Pretoria Zoo. Pseudotuberculosis, caused by this bacterium, is a common and important erosive disease especially in sheep.

Contagious pustular dermatitis or "Vuilbek" is another virus disease which seems to be pathogenic for wild mammals. A young steenbok, *Raphicerus campestris*, which had been hand-raised and kept in close association with infected goats, developed typical lesions of this disease on its lips. Contagious pustular dermatitis is highly infectious for sheep and goats and may cause mortality in these species.

Clinical signs of mange have been observed in lions, blue wildebeest, impala, buffalo and giraffe of the Kruger Park. Although only sporadic cases have been observed, extensive skin lesions may develop which often affect the general condition of infested individuals (van Niekerk 1967).

Symptoms, similar to those of ephemeral fever and aphosphorosis of cattle were observed in several buffaloes of the Kruger Park during the past two summer periods. The cause of this condition has not yet been established. Affected individuals sometimes found it hard to rise from a lying position and moved with great difficulty. One can imagine that buffalo, affected in this way, may fall easy prey to lions.

Some diseases disturb normal gestation and may be responsible for low birth-rates in infected game populations. Others are more commonly responsible for mortality in young animals. Diseases which cause perinatal mortalities in farm animals and which infect or appear to infect game animals of the Kruger Park include salmonellosis (Cameron, Tustin and Meeser 1963), brucellosis (de Vos 1967), foot-and-mouth disease, Rift Valley fever and Wesselsbron disease. Foot-and-mouth disease has been found to cause abortions in impala. Rift Valley fever and Wesselsbron disease can cause abortions and very high lamb mortality in sheep. Antibodies against the latter disease in serum specimens from wild buffaloes were so far the only indication to the possible occurrence of this disease in the Kruger Park and no perinatal mortalities could so far be attributed to this cause.

Wild primates may be affected and killed by different human diseases. A mixed infection of *Entamoeba histolytica* and *Strongyloides stercoralis*, apparently complicated with septicaemia, was for instance suspected as the cause of death in a gorilla (Smit 1967). Two orang-outangs, *Pongo pygmaeus*, of the Pretoria Zoo, also became infected with these pathogens and developed anorexia and diarrhoea and became emaciated. They fortunately recovered after treatment but it may be imagined that infected individuals of these species may also succumb to such infections in nature.

Wild rodent and carnivore populations may, apart from the dramatic diseases which have already been mentioned, also be decimated by rabies and different metazoon parasites. Young wild carnivores of different species with heavy nematode infestations were for instance often observed to be extremely emaciated. Natural cases of trichinosis have recently been diagnosed in wild rodents and carnivores of the Kruger Park. One lion developed posterior paresis as a result of the infestation and was unable to care for himself any longer. Infes-

tations of animals takes place with the ingestion of muscle meat, containing encysted larvae. Overcrowding of rodents or carnivores which may result in increased canibalism therefore presents favourable conditions for the transmission of trichinosis and this disease may, depending on its lethal effect on wild animals, play some part in the natural regulation of population numbers of wild carnivores and rodents (Young and Kruger 1967).

Various infectious diseases and parasites may also cause mortality in wild bird species. It has for instance been found that the tetramerid parasite, *Tropisurus americanus* can be responsible for mortality in young hand-reared Bald Ibises. It is believed that these birds have acquired the infestation in their natural habitat and that *T. americanus* may also kill young birds of this species in nature (Young and Kruger 1966).

One Bald Ibis, a Wahlberg's Eagle, *Aquila wahlbergi*, Lesser Flamingo, *Phoeniconaias minor*, Rock Hopper Penguin, *Euclyptes chrysocome* and several other species of exotic birds died from mycotic pneumonia, apparently caused by *Aspergillus fumigatus*. Aspergillosis may assume epizootic proportions on poultry farms and can also be expected to be of importance where wild birds are breeding in a damp and hot environment. *A. fumigatus* is capable of causing a hundred per cent mortality in infected birds. Its morbidity rate was low in the above-mentioned bird species but it proved to be highly infectious and fatal in imported species of Penguins.

Reptiles may also succumb to infections. Amongst others, mouth cancer has been responsible for mortality in several captive specimens of different African snake species and monitors. The latter animals may also be killed by *Aponomma exornatum* ticks (Young 1965).

(*c*) *Complementary infections.* Infections of this kind are generally of minor importance as mortality factors and do not, as a general rule, affect the host animal without the assistance of other decimating factors such as trauma, malnutrition, stress, senility or other infections. Tetanus, clostridia, pyogenic bacteria, several infections to which the host animal may be preimmune and some of the internal and external metazoon parasites may be quoted as examples of groups of pathogens which may be classified under this section. Internal parasites may flourish in undernourished or old specimens and aggravate the condition of infested individuals. Many different parasites have been described in African game animals and most of these are included in the excellent check-list and host-list of Neitz (1965) on the zoonoses occurring in mammals and birds in South and South West Africa.

(*d*) *Asymptomatic infections.* The three groups of diseases discussed above may be responsible for high mortality or low birth-rate which, in turn, may either cause a drastic or a gradual decline in animal numbers. They may under certain circumstances lead to the complete eradication of a particular species in a given area. Some of the sudden and inexplicable fluctuations in game populations may, therefore, be caused by the alternative effects of infectious diseases and some natural disease regulatory mechanisms.

On the other hand, examples of commensalism may be found in the case of certain wild animal species, where some of the pathogens and parasites of domestic animals can propagate in game animals without necessarily causing any direct disadvantage to their wild hosts. Bovine malignant catarrhal fever in wildebeest, African swine fever in the warthog and

bushpig, east coast fever in the Cape buffalo and nagana in several game species may be mentioned as examples. Why are these wild animals so resistant against these highly fatal diseases of domestic animals? Nobody knows, but intensive studies on this so-called natural resistance of game animals to certain infections may present valuable information which may be utilised in the artificial control of infections in both game and domestic animals. Epizootiological studies will also reveal the mode of action of different natural disease regulatory mechanisms and this knowledge may be equally well applied in the control of infectious diseases.

SUMMARY

Some of the more important infectious diseases of domestic animals may be responsible for very high mortality amongst wild animal species. The importance of the less dramatic infections on game populations is largely unknown but routine game observations, post mortem examination on game carcasses, serological and other diagnostic tests and experimental research work have indicated the high incidence of these infections in wild animals and suggested that these diseases may also play an important role in the natural regulation of game numbers. Some of the diseases, mentioned in this paper, have not yet been described in wild animals and are now reported for the first time.

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