OBSERVATIONS ON LEVELS OF INTERNAL PARASITES IN FREE LIVING RHODESIAN WILD LIFE
I. KUDU (*TRAGELAPHUS STREPSICEROS* (PALLAS, 1766))

J. B. CONDY

Veterinary Research Laboratory, Salisbury, Rhodesia

Published February, 1973

INTRODUCTION

Since wild animals have assumed greater importance as a natural resource in developing countries, it has become imperative that more be known of the natural mechanisms which control the size and density of their populations. Under natural conditions internal parasites are rarely pathogenic in wild mammals and birds. When factors, such as poor nutrition or disease, are present, however, internal parasites may aggravate the already existing disease and thereby jeopardise the survival of the species.

These factors endangered the survival of the bontebok, *Damaliscus dorcas dorcas* (Pallas 1766) in the Bontebok National Park in Bredasdorp (Barnard & Van der Walt 1961). This park was proclaimed in 1931 when the bontebok population had been reduced to 17 individuals. In 1957 the herd had increased to 95, but many of them were in poor condition and the mortality rate of new-born calves was high. It was found that they suffered from "sway back" as the result of a copper deficiency; this condition was aggravated by heavy helminth infestations. Several species of intestinal nematodes occurred in them, but they were also heavily infested with conical fluke, *Paramphistomum microbothrium* (Fischoeder 1901) as well as lungworm, *Protostrongylus capensis* (Ortlepp 1962) and *Pneumostrongylus cornigerus* (Ortlepp 1962). The high incidence of the latter two helminths was undoubtedly due to the extensive tracts of marshy terrain which provided ideal breeding conditions for the intermediate hosts of these helminths. The majority of the bontebok (84) were therefore moved to a new park in the Swellendam district in 1960. At present the herd in the park numbers 270 to 280 (de Graaff 1970).

The above instance shows the necessity for information on the identity, as well as population density, of internal parasites occurring naturally in wild animals. When wild animals are confined to nature reserves, or are domesticated, their populations rapidly attain levels at which both the abundance and the plane of nutrition may be inadequate. In such restricted areas the greater density of animals leads to heavier contamination of the grazing and ultimately results in heavy worm burdens which further endanger the survival of the host species.

At present, knowledge of the internal parasites of wild game animals is mainly confined to the identity of the parasites, while information on the numbers of a given species and the ratio of the different species occurring in any one host, is almost entirely lacking. The dearth of information on the latter two factors is to a great extent due to the difficulty of making complete collections under field conditions. Moreover, in the case of animals such as elephant, the size of the alimentary canal, as well as the great amount of ingesta, precludes the collection

of all the parasites. In the present investigation on the elephant representative samples of known size were collected and these were used to estimate the total number of individuals of each species or genus present in all the hosts examined. In the case of smaller animals, such as kudu and other antelope, total collections were made. These collections will be dealt with in a series of papers in which each species of game is treated separately.

The purpose of this investigation was to record information on levels of parasitism and to observe any obvious pathogenic effects.

METHOD

The majority of the 120 kudu examined were shot during Tsetse Game Control Operations in the Sebungwe and Chipinda areas; all but five of these animals were adult. When time permitted, total collections were made from all the organs, otherwise total collections were made from two or three organs. In some instances, due to excessive damage to carcases, collections were made from only one organ. Negative records were also kept.

The examination and collection was carried out in the following sequence:

(1) Conjunctival cavity. Searches for nematodes were made by simply probing the cavity with a small twig.
(2) Peritoneal cavity.
(3) Mesenteric veins. A search for schistosomes in mesenteric veins is only possible shortly after death before the fat in the mesentery congeals.
(4) Liver.
(5) Pulmonary vessels and heart.
(6) Lungs.
(7) Digestive tract. The abomasum, small intestine and large intestine were tied off and their contents washed into buckets. After alternate washing and sedimentation, the contents were preserved in formalin; final counts and identifications were carried out in the laboratory. Formalised blood samples were centrifuged to concentrate microfilariae and smears were examined after staining with Giemsa.

RESULTS

(1) *Conjunctival Cavity. Thelazia rhodesii* (Desmarest 1927) was recovered from 10 of 58 animals examined. The highest number found in a single conjunctival sac was 11. No evidence of any conjunctivitis was observed in infested animals.

(2) *Peritoneal Cavity. Artionema africana* (Yeh 1959) were present in 38 (59%) of 71 animals. The maximum number recovered from a single host was 114. Infestation occurred in all the localities and the majority of worms found were females. One female was seen liberating sheathed microfilariae 330 μ long. The incidence in the Sebungwe was much higher than in other localities.

(3) *Mesenteric Veins.* Schistosomes were not found in 13 animals from the Sebungwe, and 12 from Chipinda. One aged female from the Lake McIlwaine Game Park harboured a heavy infestation of *Schistosoma mattheei* (Veglia and le Roux 1929) and a few schisto-

somes were found in the portal veins of one out of 20 kudu from Kyle Game Reserve.

(4) *Liver.* Four kudu examined from the Lake McIlwaine Park harboured very heavy infestations of *Fasciola gigantica* (Cobbold 1855). One out of 18 kudu examined in the Kyle Dam Reserve harboured a light infestation.

(5) *Heart. Cordophilus sagittus* (von Linstow 1907) was recovered from 33 of 85 kudu examined; it occurred in all localities where collections were made. It was found in coronary aneurysms near the apex of the right ventricle and in the pulmonary arteries.

(6) *Lungs.* Hydatid cysts were found in two of 57 kudu examined. Unfortunately these were cut open during examination and it could not be ascertained whether they were fertile. *Dictyocaulus viviparus* (Block 1782) occurred in two localities; the incidence in the Kyle Dam National Park is much higher than in the Sebungwe. All animals harbouring this parasite had very light infestations.

(7) *Rumen.* Amphistomes were found in small numbers in all localities except the Kyle National Park.

(8) *Abomasum. Haemonchus vegliai* (le Roux 1929) occurred in all populations of kudu sampled. The highest burden was encountered in a yearling kudu (1 482 worms) in the Kyle Dam National Park.

(9) *Small intestine. Cooperia* spp. were found in three of the four localities sampled. The heaviest burdens, consisting of *Cooperia neitzi* (Monnig 1932) and *Cooperia pectinata* (Ransom 1907), were recorded at Kenilworth Estates.

Agriostomum spp. was found in 25% of kudu from two localities, the highest number of specimens in any one host being 28.

Five out of 23 kudu from the Sebungwe harboured *Moniezia* (*expansa*).

(10) *Large intestine.* Small numbers of *Oesopagostomum* sp. were present in the Sebungwe and at Chipinda; the maximum number recovered in any one host was fifteen.

Two specimens of a *Trichuris* sp. were found in one animal from Kenilworth Estates.

(11) *Blood examinations.* Seven of 25 blood samples contained microfilariae in numbers varying from rare to 3 762 per ml. Two types of microfilariae were found. Type A was sheathed and measured 230 µ. Type B was unsheathed and measured 260 µ. Type A would appear to be the microfilariae of *Cordophilus sagitta.* Type B could not be associated with an adult of the genus *Artionema* (Condy and Hill 1970).

DISCUSSION

Although several species of helminths have been recorded from kudu, there is no information on the level of infestation which occurs under natural conditions.

Round (1968) lists three species of trematodes, one adult and a larval cestode and 16 species of nematodes belonging to 11 genera from the kudu. Prior to this survey only two helminths had been recorded from kudu in Rhodesia: *Cotylophorum cotylophorum* (Fischoeder 1901) by Mettrick (1962) and *T. rhodesii* by Fitzsimons & Condy (1967). *F. gigantica* and *Moneizia* (*expansa*) recorded in this survey constitute new host records.

As the kudu is a browser and does not normally eat much aquatic vegetation, relatively few are infested with trematodes, viz. 14,3% with paramphistomes, 9,7% with *F. gigantica,*

TABLE 1

LEVELS OF HELMINTH INFESTATION IN RHODESIAN KUDU

LOCALITY:	SEBUNGWE			CHIPINDA			KYLE NATIONAL PARK			MCILWAINE NATIONAL PARK			KENILWORTH ESTATES				
	Nos. examined	Nos. positive	Range	Nos. examined	Nos. positive	Range	Nos. examined	Nos. positive	Range	Nos. examined	Nos. positive	Range	Nos. examined	Nos. positive	Range	Total examined	% positive
Thelazia rhodesii	26	4	1–11	12	3	2–6	20	3	1–6	—	—	—	—	—	—	58	17,24
Artionema africana	39	32	2–114	12	4	1–8	20	2	1	—	—	—	—	—	—	71	53,52
Schistosoma mattheei	13	—	—	12	—	—	20	1	No rec.	3	1	Hvy. infest.	—	—	—	48	4,16
Fasciola gigantica	36	—	—	12	—	—	18	1	No rec.	6	6	Hvy. infest.	—	—	—	72	9,72
Cordophilus sagitta	51	26	1–26	14	3	1–9	20	4	1–8	—	—	—	—	—	—	85	38,82
Dictyocaulus sp.	30	1	6	12	—	—	20	7	2–15	—	—	—	—	—	—	62	12,90
Paramphistomes	30	5	71–182	12	3	No rec.	20	—	—	—	—	—	1	1	12	63	14,28
Haemonchus vegliai	42	10	2–281	15	2	55–121	17	14	3–1482	—	—	—	7	6	9–145	81	39,50
Cooperia sp.	23	7	13–59	12	4	32–92	17	4	3–382	—	—	—	6	3	6–436	58	31,03
Agriostomum sp.	23	6	4–15	12	3	3–28	17	—	—	—	—	—	6	—	—	58	15,51
Avitellina sp.	23	5	—	12	2	—	17	—	—	—	—	—	6	—	—	58	12,06
Moniezia sp.	23	5	—	12	—	—	17	—	—	—	—	—	6	—	—	58	8,62
Oesophagostomum sp.	15	6	3–18	10	3	4–12	17	—	—	—	—	—	1	—	—	43	20,93
Trichuris sp.	15	—	—	10	—	—	17	—	—	—	—	—	1	1	2	43	2,32
Cestode cysts – Lungs ..	24	1	—	13	—	—	20	1	—	—	—	—	—	—	—	57	3,50
– Musculature ..	10	—	—	10	1	—	20	—	—	—	—	—	—	—	—	40	2,50

SEBUNGWE = approx. 18°S 28°E CHIPINDA = 21° 25′S 31° 50′E

and 4,2% with *S. mattheei*. Paramphistomes were not recovered from animals in the Kyle Dam National Park; the shore of this lake is steep and rocky and appears to be unsuitable for snails. In contrast to this, the shore of the Lake McIlwaine National Park has extensive reed beds which are conducive to the survival and propagation of both snails and trematodes. As a result of this, fascioliasis due to *F. gigantica* has become a problem. Kudu appear to be very susceptible to infestation and two kudu died of fascioliasis in this park. Trace (1968) found that kudu were frequently infested with *Fasciola* sp. in the Shangani district.

Although the author has found cestode cysts in the musculature of kudu in the Kalahari Desert, these have been recorded only once in Rhodesia. It is possible that the kudu examined came from localities where populations of large carnivores are either absent or minimal.

H. vegliai occurred in great numbers only in the Kyle Dam National Park where there is an unusually high population of kudu. Domestic cattle and kudu live in close contact on the Kenilworth Estates and this may account for the presence of *C. pectinata* in the kudu.

C. sagitta is common in antelopes of the genus *Tragelaphus*; in this survey it was recovered from 38,8% of the kudu examined. It is occasionally found in cattle in Rhodesia and was once also recorded from a donkey (Condy 1965). McCully *et al* (1967) recovered it from buffalo in the Republic of South Africa and Round (1968) lists it from *Kobus* sp. in Kenya.

Animals were examined for *T. rhodesii* by probing around the conjunctival cavity with a piece of straw or a long, thick hypodermic needle. It is possible that some worms lying under the muscles of the eye were missed but more accurate examinations are not possible under field conditions. This parasite appears to be confined to the Tragelaphinae in Rhodesia (Fitzsimons & Condy 1967). Dinnik *et al* record it from buffalo in Uganda.

ACKNOWLEDGEMENTS

I am indebted to Mr. N. Marsberg, J. C. Taylor, N. Laing and N. Ferrans for parasite collections; the staff of the Department of National Parks and Wild Life Management for assistance in all work carried out in National Parks – Mr. R. Hill carried out all examinations for microfilariae – and to Dr. A. Verster for assistance in producing the manuscript.

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