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HELMINTH AND ARTHROPOD PARASITES OF BLESBOK, *DAMALISCUS DORCAS PHILLIPSI*, AND OF BONTEBOK, *DAMALISCUS DORCAS DORCAS*

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ABSTRACT

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The helminth burdens of 8 blesbok shot in the north-eastern Orange Free State, 8 from the eastern Cape Province, 28 from the eastern Transvaal and 3 from the central Transvaal were determined. In addition, the arthropod burdens of 11 of these animals were ascertained. Twenty-one nematode species, 2 cestode species, 6 ixodid ticks, 2 lice and the larvae of 5 oestrid flies were recovered. Three of the nematode species, 2 of the oestrid flies and 4 of the tick species had apparently not previously been recovered from blesbok.

Thirty-one bontebok culled in the south-western Cape Province were examined for endoparasites and 8 of these animals were also examined for ectoparasites. They harboured 12 nematode species, 3 ixodid ticks, a louse and the larvae of an oestrid fly. In common with some of the blesbok they were parasitized by *Dictyocaulus magnus, Longistrongylus curvispiculum, Trichostrongylus axei, Nematodirus spathiger* and the larvae of a large *Gedoelstia* sp. Five of the nematode species, the larvae of the oestrid fly species and the 3 ixodid tick species had not previously been recorded from bontebok.

INTRODUCTION

Blesbok, *Damaliscus dorcas phillipsi*, are distributed in the Cradock and Cathcart districts in the eastern Cape Province, north and north-east through the north-eastern Cape Province and the Orange Free State to the southern Transvaal. Bontebok, *Damaliscus dorcas dorcas*, formerly distributed in the south-western Cape Province in the coastal area between Caledon and Mossel Bay, now survive only in a semi-captive state on enclosed land mainly around Bredasdorp and in the Bontebok National Park (Ansell, 1971). Round (1968) has listed the helminth parasites, Zumpt (1965) the oestrid larvae and Ledger (1980) the lice recovered from these animals. Horak (1980 a) has tabulated the helminth and arthropod parasites he has recovered from blesbok, while Verster, Imes & Smit (1975) have listed the helminths they have recovered from bontebok with those recorded by Ortlepp (1961, 1962).

The seasonal prevalence of the larvae of oestrid flies and of helminths in blesbok was determined in the northern Transvaal (Horak & Butt, 1977; Horak, 1978 a), a region considered to lie outside the original habitat of these animals (Ansell, 1971). Those blesbok were grazing Sour Bushveld (Acocks, 1975) at a low stocking density with tsessebe and roan antelope and were not examined for the presence of other ectoparasites. The numbers of parasites harboured by 2 bontebok, which died a few days after translocation from the Bontebok National Park to the National Zoological Gardens, Pretoria, were determined by Verster *et al.* (1975).

The present paper reports the worm burdens and some ectoparasite burdens of blesbok in 4 small nature reserves located in the north-eastern Orange Free State, the eastern Cape Province and the eastern and central Transvaal, and of bontebok in a small park in the south-western Cape Province.

MATERIALS AND METHODS

A total of 8 blesbok were shot at various times in the Golden Gate Highlands Park (28°31′S; 28°37′E; Alt. 1 798–2 731 m) near Clarens in the north-eastern Orange Free State, a park 4 792 ha in extent and situated in a region classified as Highland Sourveld (Acocks, 1975). It contains blesbok, black wildebeest, eland, oribi, red hartebeest, springbok and Burchell's zebra. A similar number of blesbok were shot in the Mountain Zebra National Park (32°15′S; 25°41′E; Alt. 1 200–1 957 m) near Cradock in the eastern Cape Province. This park, 6 536 ha in extent and situated in Karroid *Merxmuellera* Mountain Veld replaced by Karoo (Acocks, 1975), contains blesbok, black wildebeest, eland, gemsbok, mountain reedbuck, red hartebeest, vaal ribbok, steenbok, klipspringer, springbok and Cape mountain zebra.

Twenty-eight blesbok were shot in the Rob Ferreira Nature Reserve at Badplaas (25°57′S; 30°34′E; Alt. ± 1 067 m) in the eastern Transvaal. This reserve is situated in a region classified as Piet Retief Sourveld (Acocks, 1975) and is approximately 400 ha in extent and, in addition to blesbok, contains black wildebeest, eland, impala, oribi, springbok, tsessebe and Burchell's zebra, a total of approximately 450 animals. Two animals were shot during May 1978, 11 during June and 15 during July of the same year.

Three blesbok were shot during June 1981 in the Rietvlei Nature Reserve (25°53′S; 28°17′E; Alt. ± 1 500 m) to the south-east of Pretoria in the central Transvaal. This reserve, which is approximately 3 000 ha in extent, lies within a region classified as Bankenveld (Acocks, 1975) and, in addition to blesbok, contains black wildebeest, red hartebeest, eland, springbok, duiker, steenbok, oribi and Burchell's zebra.

Eight bontebok were shot during June 1975, 9 during September 1975, 6 during March 1976 and 8 during December 1979 in the Bontebok National Park (34°02′S; 20°25′E; Alt. 90–200 m) near Swellendam in the south-western Cape Province. The park is situated in Coastal Renosterbosveld (Acocks, 1975) and has an area of 2 786 ha. In addition to bontebok, it also contains vaal ribbok, springbok, Cape grysbok, steenbok, bushbuck and grey duiker.

The lungs and some of the livers of the blesbok and some of the lungs and livers of the bontebok were processed for worm recovery as described by Horak (1978 b), while the contents of their abomasa and small intestines were sieved separately over sieves with 38 μm apertures and that of their large intestines over sieves with 150 μm apertures. The contents of the sieves were formalinized and retained for future examination. The mucosae of the abomasa and intestinal tracts of all the blesbok at Badplaas and from near Pretoria and only those of the blesbok and the bontebok shot during December 1979 near Clarens, Cradock and Swellendam were digested with pepsin and HCl.

The nasal passages and paranasal sinuses of 2 blesbok from near Clarens, 2 from Cradock, 4 from Badplaas and 3 from near Pretoria and 8 bontebok from Swellendam

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were examined for oestrid larvae as described by Horak (1977) and their hearts washed for the recovery of these larvae, as described by Horak & Butt (1977). The cranial cavities and brain surfaces of the same 2 blesbok from Clarens and 2 from Cradock and 3 from near Pretoria and 8 bontebok from Swellendam were also examined for oestrid larvae.

The skins of the heads and of the bodies of 4 animals at Badplaas and the 3 from near Pretoria, plus all 4 legs of each animal from below the knee and hock joints with their skin intact were immersed in a tick detaching agent*. The skin of 1 side of the head and 1 side of the body, as well as 1 front leg and 1 back leg with their skin intact, of 2 blesbok at Clarens, 2 at Cradock and 8 bontebok at Swellendam were similarly processed. Thereafter the skins and legs were stored overnight in tightly closed plastic bags. The following morning they were scrubbed with brushes with 20 mm long steel bristles and thoroughly washed. The washings were sieved through sieves with 150 μm apertures and the contents of the sieves collected and preserved with formalin for future examination.

RESULTS

The mean helminth burdens of the blesbok from the Golden Gate and Mountain Zebra Parks are summarized in Table 1.

Ten nematode species were recovered from these animals. Eight of these were present in both parks, while *Nematodirus helvetianus* was present only in the Golden Gate reserve and *Nematodirus spathiger* only in the Mountain Zebra reserve. In general, the animals in the former reserve harboured more worms than those in the latter. The blesbok is a new host record for *Longistrongylus curvispiculum, Longistrongylus sabie* and *Nematodirus helvetianus*.

The ectoparasite burdens of the blesbok shot during December 1979 in the Golden Gate and Mountain Zebra Parks are summarized in Table 2.

Of the 7 species of ectoparasites recovered, only *Damalinia crenelata* was present on animals in both reserves.

The mean worm burdens of the blesbok from Badplaas are summarized in Table 3.

A total of 16 nematode and 1 cestode species were recovered from these animals. Every animal was infested with 4th state larvae of *Haemonchus* spp. and *Oesophagostomum* sp. and with adult *Dictyocaulus magnus, Longistrongylus albifrontis* and *Trichostrongylus thomasi*. With few exceptions they also harboured adult *Cooperia hungi, Cooperia yoshidai* and *Impalaia tuberculata*.

Fourth stage larvae of *Haemonchus* spp. and *Oesophagostomum* sp. constituted the major portion of the worm burdens of these 2 genera, while large numbers of 4th stage larvae of *Longistrongylus* sp., *Cooperia* spp. and *Impalaia* sp. were also recovered.

The first 2 animals shot had considerably more *Skrjabinema alata* than any other buck, but no other marked differences in worm burdens were noticeable between the various slaughter dates.

The ectoparasite burdens of 4 blesbok at Badplaas are summarized in Table 4.

TABLE 1 The mean helminth burdens of blesbok in the Golden Gate and Mountain Zebra Parks

No. of blesbok slaughtered	Date slaughtered	Mean numbers of helminths recovered												
		Dictyocaulus magnus	*Haemonchus* spp.			*Longistrongylus* spp.			*Trichostrongylus* spp.			*Nematodirus* spp.		
			H. bedfordi		*H. contortus*		*L. curvispiculum	*L. sabie*	*T. axei*	*T. colubriformis*	*T. falculatus*		*N. helvetianus	*N. spathiger*
		Adult	4th	Adult	Adult	4th	Adult	Adult	Adult	Adult	Adult	4th	Adult	Adult
Golden Gate Highlands Park														
2	June 1975	17	0	13	0	0	1 338	100	163	25	25	0	3 375	0
2	Sep. 1975	14	0	70	0	0	115	135	15	0	0	0	75	0
2	March 1976	0	38	163	0	0	50	0	0	0	0	13	175	0
2	Dec. 1979	8	3	61	20	1	169	53	25	0	0	88	203	0
Mountain Zebra National Park														
2	June 1975	5	0	0	0	0	80	0	0	518	0	30	0	520
2	Sep. 1975	1	0	0	0	0	0	135	5	0	0	0	0	30
2	March 1976	0	50	63	0	0	0	0	0	63	0	50	0	63
2	Dec. 1979	0	1	14	0	0	0	0	1	0	13	75	0	60

4th = 4th stage larvae

* New host record

TABLE 2 The ectoparasite burdens of 2 blesbok shot in the Golden Gate Park and 2 blesbok shot in the Mountain Zebra Park during December 1979

Numbers of ectoparasites recovered												
Gedoelstia cristata		*Damalinia crenelata*		*Linognathus damaliscus*		*Boophilus decoloratus		*Hyalomma marginatum turanicum	*Rhipicephalus evertsi evertsi*		*Rhipicephalus glabroscutatum	
1st	3rd	N	Adult	N	Adult	L	Adult	Adult	N	Adult	N	Adult
Golden Gate Highlands Park												
3	1	2	0	0	0	0	0	0	0	0	0	0
0	0	22	80	26	6	2	2	0	0	0	0	0
Mountain Zebra National Park												
0	0	0	2	0	0	0	0	4	0	16	0	18
0	0	8	14	0	0	0	0	0	8	4	2	8

1st, 3rd = 1st and 3rd larval stages L = Larvae N =Nymphae

* New host record

* Triatix: Coopers SA (Pty) Ltd

TABLE 3 The mean helminth burdens of blesbok shot in the Rob Ferreira Nature Reserve during 1978

No. of blesbok slaughtered	Date slaughtered	Mean numbers of helminths recovered																		Other helminths recovered
		Dictyocaulus magnus	*Haemonchus* spp.			*Longistrongylus albrifrontis*		*Trichostrongylus* spp.			*Cooperia* spp.			*Impalaia tuberculata*		*Oesophagostomum columbianum*		*Skrjabinema alata*		
				H. bedfordi	*H. contortus*				*T. axei*	*T. thomasi*		*C. hungi*	*C. yoshidai*							
		A	4th	A	A	4th	A	4th	A	A	4th	A	A	4th	A	4th	A	Imm	A	
2	17 May	20	3 323	88	0	223	776	0	1	295	1 067	832	2 588	2 070	7 041	17	2	1 488	3 488	1 animal 2 *Gongylonema* sp.
6	19 June	15	3 835	21	13	410	740	1	1	244	949	1 042	967	1 780	3 821	40	1	104	192	1 animal 328 *T. colubriformis* and 1 510 *T. falculatus;* 1 animal 1 *T. falculatus;* 1 animal 1 *Moniezia* sp.
5	28 June	12	4 270	20	0	146	860	0	70	336	616	1 745	2 730	2 261	6 246	59	2	155	820	
15	19 July	16	5 645	18	42	781	650	1	12	466	1 832	1 162	2 127	2 280	4 851	54	3	93	103	1 animal 1 *Agriostomum equidentatum* and 1 *Trichuris* sp.; 1 animal 1 *Trichuris* sp.

A = Adult
Imm = Immature worms
4th = 4th stage larvae

TABLE 4 The ectoparasite burdens of 4 blesbok shot in the Rob Ferreira Nature Reserve at Badplaas

Date slaughtered	Numbers of ectoparasites recovered														
	**Gedoelstia* sp.			*Kirkioestrus minutus*	*Oestrus macdonaldi*			*Damalinia crenelata*		*Rhipicephalus appendiculatus*			*Rhipicephalus evertsi evertsi*			**Haemaphysalis* sp.
	1st	2nd	3rd	1st	1st	2nd	3rd	Nymphae	Adult	Larvae	Nymphae	Adult	Larvae	Nymphae	Adult	Adult
17 May 1978	138	5	45	2	2	19	43	1	3	6 212	1 354	30	564	336	0	0
17 May 1978	128	6	29	67	0	0	0	0	0	11 846	2 538	27	623	158	0	1
19 June 1978	7	13	21	0	0	0	0	1	0	3 928	1 043	0	329	396	0	0
19 June 1978	67	4	29	2	0	0	0	4	28	2 376	828	4	118	231	1	0

1st, 2nd, 3rd = 1st, 2nd and 3rd stage larvae

* New host record

These animals were infested with the larvae of a *Gedoelstia* sp., the mature 3rd stage larvae of which were very large and differed in certain characteristics from those of *Gedoelstia hässleri* and *Gedoelstia cristata*. They were also infested with larvae of *Kirkioestrus minutus* and *Oestrus macdonaldi*. In addition, they harboured all sages of development of *Rhipicephalus appendiculatus, Rhipicephalus evertsi evertsi* and *D. crenelata*.

The mean helminth and arthropod parasite burdens of the 3 blesbok shot in the Rietvlei Nature Reserve near Pretoria are summarized in Tables 5 & 6.

A total of 7 nematode species, 1 cestode, the larvae of 4 oestrid fly species, a louse and 2 ixodid ticks were recovered from these animals. Of the nematodes *Impalaia nudicollis* constituted the major portion of the burden of 2 of the blesbok, while the same 2 animals also had fairly large burdens of *C. yoshidai*.

No 1st stage *Gedoelstia* sp. larvae were seen in the eyes or recovered from the brains, cranial cavities, hearts or lungs of any of the blesbok, but they were recovered from the nasal passages, which also harboured 2nd and 3rd stage *G. cristata* larvae. The nasal passages of the 3 animals also contained 1st stage larvae of *K. minutus* but no 1st stage *Oestrus* spp. larvae. These, however, were recovered from the lungs of 2 animals.

The mean helminth burdens of the bontebok are summarized in Table 7.

The lungs and the abomasal and intestinal mucosae of only the 8 animals shot during December 1979 were processed for helminth recovery. All these animals were infested with *D. magnus* and *Protostrongylus capensis;* and 1 also harboured *Pneumostrongylus cornigerus*. The majority of these animals also had large burdens of 4th stage larvae of *Longistrongylus* spp. and *N. spathiger*. The lungs of the animals shot during September 1975 were examined for the presence of lungworms. All were infested with *P. capensis*, 2 with *P. cornigerus* and 1 with *D. magnus*.

A total of 9 gastro-intestinal nematode species were recovered from the bontebok. Of these *Cooperia curticei* was present in the animals shot during 1975 and 1976 but not during 1979. The bontebok is a new host record for *Longistrongylus curvispiculum, Longistrongylus namaquensis, Cooperia curticei, Agriostomum equidentatum* and *Trichostrongylus pietersi*.

The ectoparasite burdens of the 8 bontebok shot during December 1979 are summarized in Table 8.

Haemonchus spp.		*Trichostrongylus axei*	*Cooperia yosidai*		*Impalaia nudicollis*		*Skrjabinema alata*		*Trichuris* sp.	*Avitellina* sp.
H. bedfordi	*H. contortus*									
4th	Adult	Adult	Adult	4th	Adult	4th	Adult	Imm	Adult	Adult	Scolices
70	0	75	70	75	975	280	0	100	225	0	0
75	6	5	10	370	1 925	770	5 750	50	325	1	1
1 055	26	24	50	970	4 750	1 375	19 275	0	0	0	0

Gedoelstia cristata			*Kirkioestrus minutus*	*Oestrus* spp.			*O. variolosus*	*Damalinia crenelata*		*Boophilus* sp.	*Rhipicephalus evertsi evertsi*		
					O. macdonaldi								
1st	2nd	3rd	1st	1st	2nd	3rd	3rd	Nymphae	Adults	Larvae	Larvae	Nymphae	Adults
55	12	2	90	0	2	7	0	1 148	688	8	356	144	2
129	11	9	147	3	15	30	0	6 260	4 256	0	78	30	0
31	20	17	94	8	14	23	1	128	88	0	360	192	0

1st, 2nd, 3rd = 1st, 2nd and 3rd stage larvae

TABLE 7 The mean helminth burdens of bontebok in the Bontebok National Park

No. of bontebok slaughtered	Month slaughtered	Mean numbers of helminths recovered											Other helminths recovered
		Dictyocaulus magnus	*Protostrongylus capensis*	*Haemonchus contortus*		*Longistrongylus* spp.			*Trichostrongylus axei*	**Cooperia curticei*	*Nematodirus spathiger*		
							**L. curvispiculum*	**L. namaquensis*					
		A	A	4th	A	4th	A	A	A	A	4th	A	
8	June 1975	—	—	0	0	0	3 903	584	153	38	44	1 459	
9	Sept 1975	—	Positive	0	0	7	1 177	169	72	17	35	1 125	1 animal positive *Dictyocaulus magnus;* 2 animals positive *Pneumostrongylus cornigerus;* 1 animal 2 **Agriostomum equidentatum;* 1 animal 4 390 **Trichostrongylus pietersi* and 4 390 *Trichostrongylus rugatus.*
6	March 1976	—	—	0	0	175	2 817	363	8	29	165	483	
8	Dec 1979	29	66	17	3	7 994	4 870	73	225	0	7 464	8 606	1 animal 4 *Pneumostrongylus cornigerus.*

4th = 4th stage larvae
A = Adult
* = New host record

TABLE 8 The ectoparasite burdens of 8 bontebok shot in the Bontebok National Park during December 1979

Numbers of ectoparasites recovered									
**Gedoelstia* sp.			*Damalinia* sp.		*Ixodes* sp.	**I. pilosus*	*Rhipicephalus* sp.	**R. nitens*	**Amblyomma marmoreum*
1st	2nd	3rd	Nymphae	Adult	Nymphae	Adult	Nymphae	Adult	Adult
59	26	79	12	22	0	0	5	318	0
81	36	15	4	0	2	1	5	343	0
70	25	42	0	0	6	0	7	79	0
111	19	61	0	10	0	0	2	366	0
42	16	41	0	8	0	0	8	18	1
44	25	66	0	6	0	3	4	152	0
43	31	23	0	0	0	2	2	73	0
83	28	38	0	12	7	4	4	83	0

1st, 2nd, 3rd = 1st, 2nd and 3rd larval stages

* New host record

All the buck were infested with the larvae of a *Gedoelstia* sp., the mature 3rd stage larvae of which were very large and similar in appearance to those recovered from the blesbok at Badplaas. A large proportion of the 1st stage larvae of this fly was recovered from the right ventricles of the hearts of these animals but no larvae were found in the cranial cavities. All were also infested with adult *Rhipicephalus nitens*.

DISCUSSION

A total of 21 nematode and 2 cestode species were recovered from blesbok in the 4 parks. Of these only *Haemonchus bedfordi* and *Trichostrongylus axei* were present in animals from each region. The larvae of 5 oestrid flies and the immature and/or adult stages of 6 ixodid ticks and 2 lice were also recovered. Of these only *D. crenelata* was present on animals in each of the 4 parks.

The bontebok harboured 12 nematode species, the larvae of an oestrid fly, a biting louse and 3 ixodid tick species. Of these *D. magnus, L. curvispiculum, T. axei, N. spathiger,* and the larvae of a large *Gedoelstia* species were also recovered from some of the blesbok.

Golden Gate and Mountain Zebra Parks

The small number of nematodes recovered from blesbok in both these parks is probably largely due to the low stocking density. In addition, the particularly small numbers present in the antelope in the Mountain Zebra Park can be ascribed to the fact that this is a semi-arid region with a mean annual rainfall of 398 mm.

The majority of species recovered had previously been recorded from blesbok (Horak, 1978 a) or were present in the animals slaughtered at Badplaas. *L. curvispiculum,* however, had not previously been reported in blesbok. This nematode was originally described from Grant's gazelle (Gibbons, 1973) and has also been recovered from several wild ruminants in East Africa (Gibbons, 1977).

But for its presence in the blesbok in the Golden Gate Park and in springbok near Krugersdorp in the western Transvaal (Horak, Meltzer & De Vos, 1982), *N. helvetianus* has apparently not previously been recovered from wild ruminants.

Only 1 of the 2 blesbok examined in the Golden Gate Park was infested with larvae of *G. cristata*. Four of an additional group of 5 blesbok examined in the park at the same time were infested but harboured a total of only 23 larvae.

Linognathus damaliscus was originally described from material obtained from both bontebok, which is the type-host, and blesbok (Bedford, 1936), and the *Linognathus* sp. recovered from 1 of the blesbok at Golden Gate, has provisionally been assigned to this species. Ledger (1980), however, suggests that a detailed study of adequate material may indicate that the species on blesbok differ from those on bontebok and could be a separate species as proposed by Fiedler & Stampa (1956).

Few ticks were recovered from the animals in either of the reserves, the difference in the species recovered from the 2 localities being a reflection of the differences in their geographical distributions (Howell, Walker & Nevill, 1978).

Badplaas

The blesbok at Badplaas harboured a greater number and a considerably greater variety of helminth parasites than the blesbok at Lunsklip or near Pretoria (Horak, 1978 a). Although other buck ran with the blesbok at each of those localities, the smaller area of the reserve at Badplaas, coupled with the high stocking rate, probably accounted for the larger worm burdens and greater number of species recovered.

H. bedfordi was recently recovered from blesbok for the first time (Horak, 1978 a) and, although originally described from blue wildebeest and African buffalo by Le Roux (1929), it has been recovered from numerous antelope species (Round, 1968; Gibbons, 1979). It thus appears not to be particularly host specific.

T. thomasi was originally described from impala (Mönnig, 1932, 1933) and had apparently not been encountered in any other species. However, it has recently been recovered from springbok (Horak *et al.*, 1982) and blue wildebeest (Horak, unpublished data, 1978), and the fact that all the blesbok at Badplaas were infested indicates a considerably wider host range than was previously thought. Male worms of *C. hungi* were originally described from waterbuck (Mönnig, 1931) and females from tsessebe (Mönnig, 1932) and numerous other antelope species are also infested with this worm (Round, 1968). Impala examined at Boekenhout (Horak, 1978 b) and at Pafuri (Horak, 1980 b) also harboured *C. hungi,* and it is probable that, if *T. thomasi* and *C. hungi* are not specific parasites of blesbok, the presence of a herd of 122 impala in the confined space of the reserve at Badplaas, and presumably harbouring these parasites, ensured that the blesbok became infested.

Until recently *C. yoshidai* had been recovered only from reedbuck (Mönnig, 1939) and mountain reedbuck (Baker & Boomker, 1973). It has subsequently been found in blesbok (Evans, 1978), however, and its presence in virtually every animal at Badplaas indicates that it is well-adapted to this host.

Mönnig (1932) recovered *Oesophagostomum columbianum* from blesbok artificially infested with larvae of this worm. Its presence in naturally infested blesbok has been recorded, however, by Fourie (1951) and Ortlepp

(1961), and its recovery from a large number of African antelope species (Round, 1968) seems to indicate an old association.

The recovery of a single *Agriostomum equidentatum* from 1 of the 28 blesbok examined indicates that its presence is probably accidental and a result of the fact that 93 springbok, the antelope from which it was originally described (Mönnig, 1929), grazed the reserve with the blesbok.

The recovery of *S. alata* from blesbok at Lunsklip and in the Rietvlei Nature Reserve near Pretoria (Horak, 1978 a) and Badplaas and Rietvlei in the present survey, infers that it should be considered a parasite of blesbok, although it was originally described from sheep (Mönnig, 1932).

The large proportion of early 4th stage larvae of *Haemonchus* spp., *Longistrongylus* sp., *Cooperia* spp. and *Impalaia* sp. recovered is probably because the animals were all culled during the period May–July (winter) and that these nematodes were overwintering in the blesbok as arrested 4th stage larvae.

The fairly substantial numbers of adult *L. albifrontis*, *Cooperia* spp. and *I. tuberculata* recovered from the same animals are probably the result of the warm, frost-free winters experienced at Badplaas, which makes survival outside the host possible and removes the necessity for complete inhibition of development. Even these conditions were probably not favourable for the development and survival of the free-living stages of *Haemonchus* spp. and arrest in development was virtually complete. It seems likely that the same phenomenon accounted also for the large proportion of 4th stage larvae of *Oesophagostomum* sp. recovered.

The mature 3rd stage larvae of the *Gedoelstia* sp. recovered from blesbok at Badplaas gave rise to adult flies considerably larger than adult *G. cristata* or *G. hässleri*. Basson, Zumpt & Bauristhene (1963) have described a giant variety of *G. cristata*, which they assumed to be a hybrid between *G. hässleri* and *G. cristata*. As neither *G. hässleri* nor *G. cristata* larvae were recovered from the blesbok at Badplaas, it can be assumed that no adult flies of these species were present. Hence, the larvae recovered could hardly be a hybrid between these 2 flies and probably belong to a valid separate species.

K. minutus is a parasite of blue wildebeest (Zumpt, 1965) and it has been suggested by Horak, Boomker & De Vos (1980) that, as only 1st stage larvae were recovered from the blesbok at Badplaas, it may not be capable of completing its parasitic life cycle in this host. *O. macdonaldi* has been recovered from blesbok near Pretoria and near Lunsklip in the northern Transvaal (Horak & Butt, 1977). Third stage larvae of this fly appear to be present only from May–September (Horak & Butt, 1977).

The large burdens of immature *R. appendiculatus* present on the blesbok were probably due to 3 factors. Firstly, the time of the year, as peak immature activity occurs between March and September (Londt, Horak & De Villiers, 1979); secondly, the high stocking density in the reserve which thus supplies an abundance of hosts for all stages of development and, thirdly, the presence of eland, which are good hosts for adult ticks and which in turn give rise to large immature populations.

The large numbers of immature *R. evertsi evertsi* can also be ascribed to the 1st 2 of the above-mentioned 3 factors and to the presence of zebras in the reserve, as these animals are good hosts of the adults of this tick (Horak, unpublished data, 1980).

Rietvlei Reserve

The parasite burdens of the blesbok in this reserve are of interest, not only because they can be compared with those of the blesbok in other reserves, but also because they can be compared with those of 4 blesbok shot almost exactly 9 years previously in the same reserve (Horak & Butt, 1977; Horak, 1978 a).

In contrast to the blesbok at Badplaas, which harboured *I. tuberculata*, these animals were infested with *I. nudicollis*, a parasite also recovered from blesbok in the Percy Fyfe Nature Reserve in the northern Transvaal (Horak, 1978 a). Each of the 3 blesbok from the Rietvlei Reserve also harboured *C. yoshidai*, a parasite recovered from nearly all the animals at Badplaas but not recovered from the 4 blesbok shot 9 years previously in the Rietvlei Reserve (Horak, 1978 a).

Horak & Butt (1977) also recovered large numbers of 1st stage larvae (which they assumed to be *Oestrus* spp.), from the nasal passages of those 4 blesbok. One of those animals also harboured *Oestrus* spp. larvae in its lungs. At the time, the 1st stage larvae of *K. minutus*, which have only recently been described (Horak *et al.*, 1980), were not known. However, because of the findings in the 3 blesbok in the present survey in the Rietvlei Reserve, the 1st stage larvae recovered from the nasal passages of the previously examined blesbok were re-examined and found to be 1st stage larvae of *K. minutus*. Unfortunately, the larvae recovered from the lungs of 1 of those animals had been lost, and thus it could not be determined if they were indeed *Oestrus* sp. larvae.

It was also suggested by Horak & Butt (1977) that 3rd stage larvae of *O. macdonaldi* were present in blesbok only during the period May–Sepember, a suggestion now supported by the fact that 1 of the blesbok slaughtered at Badplaas during May 1978 harboured these larvae, as did the 3 blesbok now examined in the Rietvlei Reserve. They also suggested that, if blesbok in the Rietvlei Reserve were examined at other times of the year, they might be found to harbour *Oestrus variolosus* as well. The recovery of a single 3rd stage larva of *O. variolosus* from 1 of the animals now examined and from 3 black wildebeest culled a little later in the Rietvlei Reserve confirms that this parasite does occur in this reserve.

Each of the 3 blesbok was infested with larvae of *G. cristata*, and on re-examination of the larvae recovered from the 4 blesbok previously examined at Rietvlei it was found that all the larvae previously identified as *G. hässleri* were in fact also *G. cristata* larvae.

The presence of substantial numers of immature *R. evertsi evertsi* in the ears of the blesbok was probably due to the presence of zebras in the Rietvlei Reserve.

Bontebok Park

Although *D. magnus* was originally described from the closely related blesbok (Mönnig, 1932), it seems equally well adapted to bontebok. It would appear, however, that this parasite was not introduced into the present Bontebok Park with the bontebok when they were transferred thither from the old Bontebok Park near Bredasdorp during 1960, a fact also mentioned by Verster *et al.* (1975). This observation is supported by the fact that no *D. magnus* were recovered from the animals in the original park before they were transferred (Ortlepp, 1962). Springbok, which are also good hosts of *D. magnus*, were subsequently introduced into the new park (Penzhorn, 1971) and the infestation probably came with them. Both *Pneumostrongylus cornigerus* and *Protostrongylus capensis* were originally described from bontebok (Ortlepp, 1962).

Longistrongylus namaquensis was originally described from the abomasum of a sheep (Ortlepp, 1963), but has subsequently been found in springbok in the Bontebok National Park (Horak *et al.*, 1982). It may well prove to be a parasite of wild ruminants in common with the other members of this genus (Gibbons, 1977).

More than 60% of the total *Longistrongylus* spp. burdens of the animals culled during December 1979, the abomasal mucosae of which had been digested, were in the 4th stage of larval development. This can probably be ascribed to arrested development ensuring the survival of the nematode in a stable internal environment during a time when the external dry and hot conditions of summer in the western Cape Province are unsuitable for survival of the free-living stages. Unfortunately this statement cannot be substantiated from a comparison with the burdens of the animals slaughtered during June and September 1975 and March 1976. The abomasal mucosae of these animals had not been digested and, consequently, their burdens of *Longistrongylus* spp. larvae cannot be considered complete, as very large numbers of 4th stage larvae of this genus are frequently present in the mucosa of the abomasum.

The presence of large numbers of adult *N. spathiger* in adult bontebok is worth noting. In a helminth survey conducted in sheep in the Karoo, Viljoen (1969) found that once the sheep reached 12–15 months of age, regardless of the season of the year, fewer *N. spathiger* became adult. He thought that this was probably a manifestation of age resistance similar to that found against this and other species of the genus (Brunsdon, 1962 a). Whether the large proportion of adult *N. spathiger* found in the present survey was indicative of a well-adapted, definitive host/parasite relationship (Horak, 1980 b) or of a decrease in host resistance brought about by inadequate nutrition (Brunsdon, 1962 b) or by the presence of large burdens of other parasites, could not be determined within the limits of this survey.

Few *N. spathiger* larvae were recovered from the digested intestinal mucosae of the animals slaughtered during December 1979. Hence the larval burdens of this species in the animals culled during 1975 and 1976 can be taken as a reasonably accurate reflection of the actual number of larvae present. From these observations it would appear that a degree of arrested development in the 4th larval stage was present during December 1979.

Verster *et al.* (1975) recovered fairly large numbers of *Ostertagia hamata* and *N. spathiger* from the bontebok they examined during 1973. Although *O. hamata* was absent in all the bontebok examined in the present survey, *N. spathiger* was recovered in large numbers.

The recovery of larvae of a very large *Gedoelstia* sp. from the bontebok in the absence of larvae of either *G. cristata* or *G. hässleri* is further support for our contention that this is a valid, separate species. The fairly large numbers of 1st stage larvae found in the hearts of the antelope, while none were present around the brains, suggests that the larvae of these flies follow a migratory route from the cornea to the blood vessels, heart, lungs, trachea, pharynx and nasal cavity in preference to the route via the cornea, optic nerve, dura mater and foramina of the cribriform plate to the nasal cavity (Horak & Butt, 1977).

The *Damalinia* sp. recovered from the bontebok has only been identified to generic level, as it is probable that this is an unnamed new species (Ledger, 1980).

The large numbers of adult *R. nitens* recovered from the bontebok indicate that they are efficient hosts of this tick, which has a geographical distribution limited to the south-western Cape Province (Morel, 1969). The single adult *Amblyomma marmoreum* recovered is an indication of the presence in the park of a large number of tortoises, which this tick parasitizes (Hoogstraal, 1956).

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