

HELMINTH PARASITES OF GRYSBOK, COMMON DUIKERS AND ANGORA AND BOER GOATS IN THE VALLEY BUSHVELD IN THE EASTERN CAPE PROVINCE

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ABSTRACT

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Helminth parasites were collected from 13 grysbok, *Raphicerus melanotis*, 12 common duikers, *Sylvicapra grimmia*, 24 Angora goats and 24 Boer goats killed on a farm in Valley Bushveld in the eastern Cape Province. Nematodes belonging to 9 species and a further 2 genera and cestodes belonging to 1 species and a further genus were recovered from the grysbok. Of these, worms of the genus *Skrjabinema*, *Trichostrongylus rugatus*, *Trichostrongylus pietersei* and *Nematodirus spathiger* were the most prevalent and the most numerous. An amended list of the helminths of grysbok is included.

Seven nematodes, identified to species and 1 identified to genus were recovered from the common duikers. *N. spathiger* and *Setaria scalprum* were the most prevalent, while *N. spathiger* and *Trichostrongylus axei* were the most abundant.

The Angora goats were infested with at least 10 nematode species and 2 cestodes and the Boer goats with at least 14 nematode species. With the exception of *Trichostrongylus pietersei*, the Boer goats harboured more nematodes of each species than did the Angora goats. *Nematodirus* spp. and worms of the genus *Skrjabinema* were most numerous in Angora goats, and *Nematodirus* spp. and *Teladorsagia circumcincta* in the Boer goats.

No clear pattern of seasonal abundance was evident for any of the helminth species in the various hosts.

INTRODUCTION

Grysbok, *Raphicerus melanotis*, are small antelope that are endemic to the Cape Province of the Republic of South Africa. They are confined to the western, south-western and eastern parts of the province and are associated with thick scrub bush on the lower level of hills, in kloofs, coastal forest or succulent veld (Smithers, 1983). They are nocturnal and are predominantly grazers, but will take leaves and wild fruit on occasion. They are a problem species where vines are grown, since they nibble off the young shoots at night (Smithers, 1983).

Round (1968) lists only *Haemonchus contortus* and *Impalalia tuberculata* as occurring in these antelope. Both these records, however, should be treated with reserve. No other records could be found in the literature.

The habits, food preferences and parasites of common duikers, *Sylvicapra grimmia*, have been summarized and commented on by Boomker, Du Plessis & Boomker (1983); also the list of their helminth parasites was updated by Boomker, Keep & Horak (1987).

Both Angora and Boer goats are farmed extensively in the Valley Bushveld regions of the eastern Cape Province and the browsing habits of these animals in this vegetation type have been observed by Aucamp (1979). The helminth parasites recovered from goats in the eastern Cape Province have been recorded by Horak (1987).

MATERIALS AND METHODS

Study area

The farm 'Brakhill' (33° 33' S; 25° 25' E) comprises approximately 4 000 ha of hilly country, rang-

ing in altitude from 200–400 m. It is situated in a low rainfall region, which, although lying on the coastal plateau, receives approximately only 300 mm per annum.

Vegetation is typically Fish River Scrub (Jacot Guillarmod, Rhodes University, personal communication, 1986), which, according to Acocks (1975), is a subdivision of the Valley Bushveld complex. This vegetation is characterized by the dominance of *Portulacaria afra* (spekboom or elephant bush) and the presence of *Grewia robusta*, *Crassula argentea*, *Azima tetraacantha* and other plants of this association. Included in this community are pockets of over-exploited, open, low scrub and herb growth, often dominated by *Cynodon incompletus*, and presumably, judging by their remains, interlocked matted plants of *Galenia* spp. and *Atriplex semibaccata* or *Psilocaulon* spp. The grazing potential of the area is low, but browse is plentiful.

The grysbok and duikers were shot wherever they were found on the farm, whereas the goats came from a mixed flock of approximately 70 Angora and Boer goats running in a camp 355 ha in extent. In addition to the grysbok, duikers and survey goats, numerous kudu, *Tragelaphus strepsiceros*, approximately 3 000 Angora goats and 600 Boer goats were present on the farm.

Survey animals

One grysbok and 1 common duiker were shot at night each month from February 1983 to January 1984. During March 1983, however, 2 grysbok were shot, and during April 1983, 2 common duikers. A common duiker could not be secured during December 1983.

Also from February 1983 to January 1984, 2, 2–3-year-old Angora goats and 2 similarly aged Boer goats, none of which had been treated with an anthelmintic during at least the preceding 4 months, were slaughtered at monthly intervals.

Helminth recovery

The lungs, hearts and livers were processed for helminth recovery, as described by Horak (1978a), and examined *in toto*. The abomasa, small intestines

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TABLE 1 Amended list of the helminth parasites of grysbok, *Raphicerus melanotis* (Thunberg, 1811), in the Republic of South Africa with reference to the first record and the authors used to assist with the identification

Helminth species	First record	Identification
Cestodes		
<i>Taenia hydatigena</i> Pallas, 1766, larvae	This paper	Verster, 1969
<i>Thysaniezia</i> sp.	This paper	Skrjabin & Spasski, 1963
Nematodes		
<i>Haemonchus contortus</i> (Rudolphi, 1803) Cobb, 1898	Mönnig, 1931	*
<i>Haemonchus</i> sp. female	This paper	Gibbons, 1979
<i>Impalaia tuberculata</i> Mönnig, 1923	Mönnig, 1933	*
<i>Longistrongylus sabie</i> (Mönnig, 1932) Travassos, 1937	This paper	Gibbons, 1977
<i>Nematodirus spathiger</i> (Railliet, 1896) Railliet & Henry, 1909	This paper	Becklund & Walker, 1967
<i>Setaria</i> sp.	This paper	Yeh, 1959
<i>Skrjabinema</i> spp.	This paper	Mönnig, 1932
<i>Teladorsagia circumcincta</i> (Stadelmann, 1894) Drózdzy, 1965	This paper	Ransom, 1911
<i>Trichostrongylus axei</i> (Cobbold, 1879) Looss, 1905	This paper	Ransom, 1911
<i>Trichostrongylus deflexus</i> Boomker & Reinecke, 1989	This paper	Boomker & Reinecke, 1989
<i>Trichostrongylus pietersei</i> Le Roux, 1932	This paper	Le Roux, 1932
<i>Trichostrongylus rugatus</i> Mönnig, 1925	This paper	Mönnig, 1925
<i>Trichuris</i> sp.	This paper	Sarwar, 1959

* After Round, 1968. Not found in this survey. Both these records should be treated with reserve

TABLE 2 Total worm burdens* of grysbok, common duikers and Angora and Boer goats in Valley Bushveld

Month	Actual burdens		Actual (mean) burdens	
	Grysbok	Common duikers	Angora goats	Boer goats
Feb. 1983	321	32	50, 282 (166)	2 640, 6 039 (4 340)
Mar. 1983	944, 331	110	106, 158 (132)	130, 1 851 (991)
Apr. 1983	—	2	291, 530 (411)	75, 1 926 (1 001)
May 1983	80	93	187, 422 (305)	31, 610 (321)
Jun. 1983	454	492	241, 621 (431)	25, 650 (338)
Jul. 1983	3 017	0	261, 495 (378)	25, 125 (75)
Aug. 1983	800	0	336, 560 (448)	400, 652 (526)
Sep. 1983	10	32	870, 895 (883)	25, 2 336 (1 181)
Oct. 1983	40	410	270, 865 (568)	470, 1 539 (1 005)
Nov. 1983	80	0	100, 150 (125)	423, 966 (695)
Dec. 1983	760	—	1 245, 2 587 (1 916)	257, 2 552 (1 405)
Jan. 1984	10	333	880, 1 886 (1 383)	958, 1 117 (1 038)

* Excluding worms of the genus *Skrjabinema*

— No antelope shot during these months

TABLE 3 Helminths recovered from 12 grysbok in Valley Bushveld in the eastern Cape Province

Helminth species	Number of worms recovered			Number of animals infested
	Larvae	Adults	Total	
Cestodes				
<i>Taenia hydatigena</i>	1	#	1	1
<i>Thysaniezia</i> sp.	#	3	3	2
Nematodes				
<i>Haemonchus</i> sp. females	0	1	1	1
<i>Longistrongylus sabie</i>	0	124	124	4
<i>Nematodirus spathiger</i>	50	511	561	5
<i>Skrjabinema</i> spp.	—	31 550	31 550	10
<i>Teladorsagia circumcincta</i>	0	20	20	1
<i>Trichostrongylus deflexus</i>	—	4	4	1
<i>Trichostrongylus falculatus</i>	—	159	159	4
<i>Trichostrongylus pietersei</i>	—	3 853	3 853	8
<i>Trichostrongylus rugatus</i>	—	2 096	2 096	9
<i>Trichostrongylus</i> spp. females and larvae	0	20	20	2
<i>Trichuris</i> sp. females	—	10	10	1
Mean nematode burden*	4	567	571	

Do not occur in ruminants

— Not applicable

* Excluding the genus *Skrjabinema*

and large intestines were processed as described by Reinecke (1973). One aliquot, representing 1/10th of the volume of the ingesta, was made for each of the abomasa, the small intestines and the large intestines of the antelopes. Two aliquots, each representing

1/10th of the volume of the ingesta of each of these organs, were made for the goats. All these aliquots were examined under a stereoscopic microscope.

The nematodes were cleared in lactophenol and identified under a standard microscope. The worms

TABLE 4 Helminths recovered from 11 common duikers in Valley Bushveld in the eastern Cape Province

Helminth species	Number of worms recovered			Number of animals infested
	Larvae	Adults	Total	
Cestodes				
<i>Thysaniezia</i> sp.	#	4	4	2
Nematodes				
<i>Longistrongylus sabie</i>	0	82	82	2
<i>Nematodirus abnormalis</i>	*	60	60	1
<i>Nematodirus spathiger</i>	*	741	741	5
<i>Nematodirus</i> spp.	120	—	120	1
<i>Setaria scalprum</i>	—	11	11	4
<i>Teladorsagia circumcincta</i>	0	23	23	2
<i>Trichostrongylus axei</i>	0	333	333	3
<i>Trichostrongylus</i> sp. females	—	60	60	2
<i>Trichuris</i> sp. females	—	70	70	2
Mean nematode burden	11	125	136	

Do not occur in ruminants

— Not applicable

* Larvae indistinguishable at species level. Counted together under the genus types

TABLE 5 Helminths recovered from 24 Angora goats in Valley Bushveld in the eastern Cape Province

Helminth species	Number of worms recovered			Number of animals infested
	Larvae	Adults	Total	
Cestodes				
<i>Moniezia</i> sp.	#	1	1	1
<i>Thysaniezia</i> sp.	#	1	1	1
Nematodes				
<i>Nematodirus abnormalis</i>	*	675	675	6
<i>Nematodirus spathiger</i>	*	1 875	1 875	16
<i>Nematodirus</i> spp.	4 558	—	4 558	17
<i>Oesophagostomum venulosum</i>	0	1	1	1
<i>Ostertagia ostertagi</i>	*	25	25	1
<i>Teladorsagia circumcincta</i>	*	2 057	2 057	17
<i>Ostertagia/Teladorsagia</i> spp.	95	—	95	8
<i>Skrjabinema</i> spp.	0	12 827	12 827	15
<i>Trichostrongylus axei</i>	*	1 553	1 553	20
<i>Trichostrongylus pietersei</i>	*	2 050	2 050	12
<i>Trichostrongylus rugatus</i>	*	1 383	1 383	15
<i>Trichostrongylus</i> sp.	1	0	1	1
<i>Trichuris</i> sp.	—	15	15	5
Mean nematode burden**	194	401	595	

Not found in ruminants

— Not applicable

* Larvae indistinguishable at species level. Counted together under the respective genus types

** Excluding the genus *Skrjabinema*

of the grysbok were identified, using the descriptions of the authors listed in Table 1. This table also lists the worms recovered to date from grysbok. An amended list of the helminths of common duikers was published in an earlier paper (Boomker *et al.*, 1987) and the helminths recovered from the antelope in the present survey are listed there. The helminths from the goats were identified using the descriptions of the authors listed by Horak (1980).

Climate

Rainfall and atmospheric temperatures were recorded on the farm.

RESULTS

The total monthly worm burdens, excluding worms of the genus *Skrjabinema*, of each of the ruminant species are presented in Table 2.

Grysbok (Table 3)

Only the lungs and the abomasum of the grysbok

shot during April 1983 were received. The bottle marked 'Lung' contained 1 *Setaria* female, while 1 *Trichostrongylus pietersei* male, 10 *Trichostrongylus axei* males and 1 *Longistrongylus*-type female were recovered from the abomasum. The worms of this animal are included in the parasite list (Table 1), but not in Table 3.

Eight nematodes identified to species level and 2 identified to genus were recovered from the remaining 12 antelope. Worms of the genus *Skrjabinema* were the most abundant and the most prevalent nematodes, followed by *Trichostrongylus rugatus*, *Trichostrongylus pietersei* and *Nematodirus spathiger*.

The largest burden of 7 517 nematodes was present in the antelope shot during July 1983, and the smallest burden of 40 nematodes in the antelope shot during October 1983. The mean nematode burden was 3 200, 2 629 of which were worms belonging to the genus *Skrjabinema*. Total worm burdens appeared to be higher from August 1983 to January

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TABLE 6 Helminths recovered from 24 Boer goats in Valley Bushveld in the eastern Cape Province

Helminth species	Number of worms recovered			Number of animals infested
	Larvae	Adults	Total	
Nematodes				
<i>Haemonchus contortus</i>	0	55	55	7
<i>Nematodirus abnormalis</i>	*	1 375	1 375	7
<i>Nematodirus spathiger</i>	*	2 400	2 400	12
<i>Nematodirus</i> spp.	8 025	—	8 025	18
<i>Oesophagostomum venulosum</i>	0	6	6	3
<i>Ostertagia harrisi</i>	*	20	20	1
<i>Ostertagia ostertagi</i>	*	95	95	1
<i>Teladorsagia circumcincta</i>	*	4 643	4 643	20
<i>Teladorsagia trifurcata</i>	*	197	197	6
<i>Ostertagia/Teladorsagia</i> spp.	546	—	546	9
<i>Skrjabinema</i> spp.	—	1 338	1 338	10
<i>Trichostrongylus axei</i>	*	3 984	3 984	14
<i>Trichostrongylus falculatus</i>	*	25	25	1
<i>Trichostrongylus pieterse</i>	*	1 675	1 675	8
<i>Trichostrongylus rugatus</i>	*	2 650	2 650	13
<i>Trichostrongylus</i> sp.	80	—	80	2
<i>Trichuris</i> sp.	1	45	46	7
Mean nematode burden**	360	810	1 170	

— Not applicable

* Larvae indistinguishable at species level. Counted together under the respective genus types

** Excluding the genus *Skrjabinema*

1984 than from February to July 1983 but because of the small number of antelope shot each month, these figures could not be statistically compared. Peak numbers of *Trichostrongylus* spp. occurred from February to March and again from June to August 1983.

A single *Thysaniezia* sp. was found in the small intestine of the grysbok shot during May 1983 and one *Taenia* sp. larva with rostellar hooks that resembled those of *Taenia hydatigena* from the antelope shot during October 1983.

Common duikers (Table 4)

Only the abomasum of 1 of the 2 duikers shot during April 1983 was received and only 4 *Trichostrongylus pieterse* were recovered. The helminths from this antelope were excluded from Table 4, but were added to the amended list of parasites as *Trichostrongylus pietersi* (a typographical error) (Boomker et al., 1987).

At least 7 nematode species and a cestode were recovered from the remaining 11 antelope. *N. spathiger* and *Setaria scalprum* were the most prevalent nematodes and *N. spathiger* and *Trichostrongylus axei* the most abundant.

The largest burden of 429 nematodes was present in the duiker shot during June 1983 and consisted mostly of *N. spathiger* (420). Three duiker harboured no worms. The mean nematode burden was 136. The total worm burdens from August 1983 to January 1984 (727) were almost the same as those from February to July 1983 (773), and no pattern of seasonal abundance could be discerned for any of the helminths.

Angora goats (Table 5)

At least 10 nematode species were recovered, of which *Nematodirus* spp., *Teladorsagia circumcincta* and *Trichostrongylus axei*, were the most prevalent. *Nematodirus* spp. and worms of the genus *Skrjabinema* were most abundant. All the goats were infested and, excluding the worms of the genus *Skrjabinema*, the highest burden of 2 587 nematodes was present in a goat examined during December 1983, and the lowest of 50 worms in a goat examined during February 1983. Mean total monthly worm burdens appeared to be generally higher from August 1983 to January 1984 than from February to July 1983, but due to insufficient data, no statistical comparisons could be made.

Boer goats (Table 6)

These animals were infested with at least 14 nematode species, of which *Nematodirus* spp., *Teladorsagia circumcincta* and *Trichostrongylus axei* were the most prevalent and the most abundant. All the goats

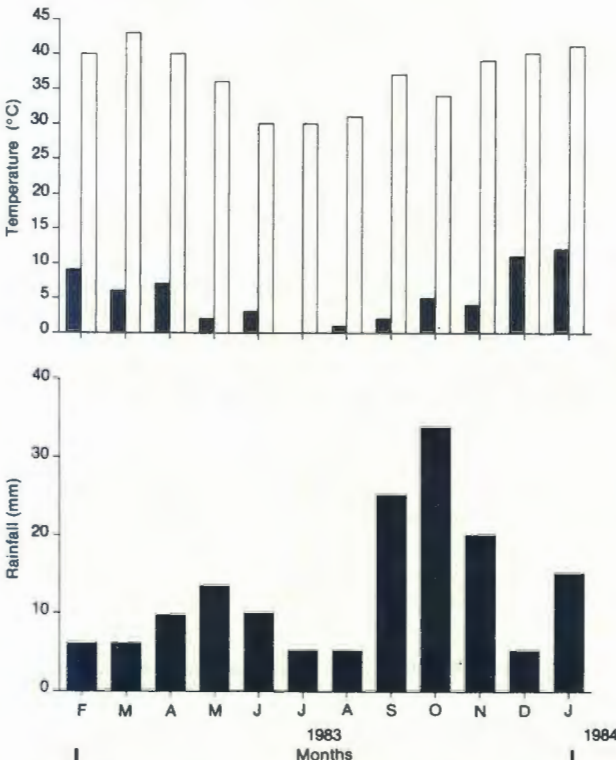


FIG. 1 The monthly mean maximum and minimum atmospheric temperatures and monthly rainfall on the farm 'Brakhill' from February 1983 to January 1984

were infested and the total burdens varied from 25 to 6 039 worms. The mean total monthly worm burdens appeared to be larger from September 1983 to January 1984 than from March to August 1983 but statistical comparisons could again not be made because of insufficient data.

Climate

The monthly mean maximum and minimum atmospheric temperatures and total monthly rainfall are graphically illustrated in Fig. 1.

Maximum temperatures were close to or exceeded 40 °C from February to April 1983 and during December 1983 and January 1984. Mean minimum temperatures below 5 °C were recorded from May to November 1983. Total rainfall was 159 mm and exceeded 20 mm per month from September to November 1983.

DISCUSSION

Grysbok

The records of helminths from grysbok cited by Round (1968) were those of Mönning (1931, 1933) and should be treated with reserve. Mönning (1931) states that 9 male and 10 female *H. contortus* were recovered from 'steenbok (*Raphiceros rufescens*), (sic) female, 2-tooth. Received 21.3.30 from Louis Trichardt, northern Transvaal'. In the same publication, however, he lists *H. contortus* as being recovered from 'Steenbok, *Raphiceros campestris*'. It is, therefore, not clear if he refers to 2 separate host animals, or if a mistake was made with the initial identification of the host and later rectified. The specific name *R. rufescens* (= *R. melanotis*) applies to grysbok, or, as they are sometimes known, Cape grysbok. These antelope have not been recorded further north than 30° S (Smithers, 1983), while Louis Trichardt is situated north of 24° S. Mönning's (1931) records of *H. contortus*, therefore, are from steenbok, *Raphiceros campestris*, or possibly Sharpe's grysbok, *Raphiceros sharpei*, both of which occur in the northern Transvaal.

Mönning (1933) does not give the locality of the 'steenbok, *Raphiceros rufescens*' (sic) from which he collected *I. tuberculata*. This, together with the fact that there is some doubt as to the correctness of his host identification, also places the record of *I. tuberculata* from grysbok under suspicion.

All the helminths recovered during this survey appear to be new records for grysbok.

Common duikers

The mean total helminth burdens of the duikers were smaller, and fewer nematode species were recovered, than from the grysbok. This could be due to the fact that fewer infective larvae are ingested by duikers because of their selective feeding habits, the animals preferring browse to grazing.

The mean total worm burden of the duikers was also lower than those of duikers in the central Transvaal (Boomker *et al.*, 1983), but not of the same antelope from southern Natal (Boomker *et al.*, 1987), which harboured mean total nematode burdens of 870 and 60 respectively. Valley Bushveld is a habitat that can generally be considered unfavourable for the survival of the free-living stages of parasitic nematodes. This is because of the very high temperatures and frequently very low rainfall during the summer months (Fig. 1) and the sparseness of grass cover. This not only exposes the free-living stages of helminths to adverse climatic conditions

but also causes animals to browse rather than graze, hence they ingest fewer infective larvae.

Goats

Excluding worms of the genus *Skrjabinema*, the mean total worm burdens of the Angora goats (595) and number of nematode species recovered (at least 10) were not unlike those of the grysbok (571 and at least 11), both of which were considerably lower than those of the Boer goats (1114 and at least 14). It would thus seem as if the grazing and browsing habits of the Angora goats and grysbok were fairly similar. The higher burdens of the Boer goats indicate either that they are more susceptible to nematodes than Angora goats or that they spend more time grazing and less time browsing than do Angora goats. Aucamp (1979), however, found that the converse was true and that the average preference for grass was 25 % for Boer goats and 33 % for Angora goats.

Although the survey goats were confined to a single camp on the farm, they were not isolated from grysbok, duikers or other antelope which had free access to the camp, as the fences did not restrict their movement. Likewise, the grysbok and duikers, which were shot at various localities on the farm, were not isolated from goats, which, depending on management practices, grazed several camps on the farm. Cross-infestation with each other's parasites was thus always possible.

Helminths

Host associations

The host-spectrum of those adult nematodes which were specifically identified in the various host species is summarized in Table 7.

Fifteen nematode species were classified in this way. Of these, only *N. spathiger* and *Teladorsagia circumcincta* were recovered from each of the 4 host species, while *Nematodirus abnormalis*, *Trichostrongylus axei*, *Trichostrongylus pieterse* and *Trichostrongylus rugatus* were present in 3 of the host species. These host associations and other aspects of the biology of some of the helminths are discussed in greater detail below.

Seasonal abundance

The number of nematodes of individual species recovered were too small to permit the determination of patterns of seasonal abundance. Excluding worms of the genus *Skrjabinema*, however, the increase in the total worm burdens of the goats during the period August or September to January or February (Table 2) is similar to that observed by Horak (1987) in Angora goats and Dorper sheep on a farm in Valley Bushveld near Grahamstown in the eastern Cape Province. This pattern of abundance can possibly be linked to an increase in temperature coupled with rainfall during spring, causing the sprouting of grass. To meet their nutritional requirements, the animals concentrate on this grass rather than browse, resulting in increased worm burdens during spring.

The Valley Bushveld regions of the eastern Cape Province have relatively mild winters, and few, if any, nematode larvae are arrested in their hosts in order to survive this season (Horak, 1987). The spring rise in nematode burdens is therefore not due to the maturation of arrested larvae.

Excluding worms of the genus *Skrjabinema*, the total nematode burdens in the grysbok showed the

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TABLE 7 The host spectrum of adult nematodes recovered from antelope and goats on a farm in Valley Bushveld in the eastern Cape Province

Nematode species	Mean burdens (% of animals infested)			
	Grysbok	Common duikers	Angora goats	Boer goats
<i>Haemonchus contortus</i>	0	0	0	2 (29)
<i>Longistrongylus sabie</i>	10 (33)	7 (18)	0	0
<i>Nematodirus abnormalis</i>	0	5 (9)	28 (25)	96 (29)
<i>Nematodirus spathiger</i>	43 (42)	67 (45)	78 (67)	100 (50)
<i>Oesophagostomum venulosum</i>	0	0	<1 (4)	<1 (13)
<i>Ostertagia harrisi</i>	0	0	0	1 (4)
<i>Ostertagia ostertagi</i>	0	0	1 (4)	4 (4)
<i>Setaria scalprum</i>	0	1 (36)	0	0
<i>Teladorsagia circumcincta</i>	2 (8)	2 (18)	86 (71)	193 (83)
<i>Teladorsagia trifurcata</i>	0	0	0	8 (25)
<i>Trichostrongylus axei</i>	0	30 (27)	65 (83)	166 (58)
<i>Trichostrongylus deflexus</i>	<1 (8)	0	0	0
<i>Trichostrongylus falculatus</i>	13 (33)	0	0	1 (4)
<i>Trichostrongylus pietersei</i>	321 (67)	0	85 (50)	70 (33)
<i>Trichostrongylus rugatus</i>	175 (75)	0	58 (63)	110 (54)

same seasonal pattern of abundance as that seen in the goats. The total number of nematodes recovered from the grysbok from August to January was 5 147, while the total burden from February to July was 1 700. However, the total burdens of the common duikers were approximately equal (727 and 773) during the 2 periods.

Haemonchus contortus

Very few worms were recovered and then only from the Boer goats. We consider this to be a definitive parasite of sheep and possibly also of goats. Its presence in antelope must be considered accidental and due to cross-infestation from domestic stock. Horak (1987) has ascribed the low burdens of this species encountered in sheep and goats in Valley Bushveld to the sparse grass-cover in this vegetation type, and hence the exposure of the infective larvae to the harsh summer environment.

Longistrongylus sabie

This nematode was originally described from impala, *Aepyceros melampus* (Mönnig, 1933), and fairly large numbers may be recovered from these antelope (Horak, 1978b). Its presence in small numbers in some of the grysbok and common duikers in the absence of impala in the present survey indicate that these antelope may be suitable occasional hosts.

Horak (1978c) has recovered *L. sabie* as an accidental parasite from cattle sharing a habitat with impala. Its absence in the goats on the farm 'Brak-hill' may simply be a reflection of the small worm population present and not that goats are resistant to infestation.

Nematodirus spp.

N. abnormalis was recorded in South Africa for the first time by Horak (1987). It was originally described from a Maltese goat in the United States of America by May (1920). Its recovery from duikers and goats in the present survey as well as from sheep in the western Cape Province (Louw, 1989) indicates that it is fairly widespread in the southern regions of this country.

N. spathiger probably occurs in the greatest numbers in animals in the Cape Province (Horak, 1981). Here it is encountered in sheep (Barrow, 1964; Ros-siter, 1964; Viljoen, 1964, 1969; Muller, 1968; Reinecke, Kirkpatrick, Swart, Kriel & Frank, 1987), goats (Horak, 1987) and several antelope species

(Horak, Meltzer & De Vos, 1982; Horak, Brown, Boomker, De Vos & Van Zyl, 1982; Horak, De Vos & De Klerk, 1982). Its recovery from each of the host species in the present survey is therefore not surprising.

The mean number of adult worms recovered varied from 43 in the grysbok to 100 in the Boer goats, indicating that all the hosts were probably equally suitable. The relatively high proportion of *Nematodirus* spp. larvae recovered from the goats can probably be ascribed to the fact that these animals were adult and this genus appears to prefer young animals (Viljoen, 1969). However, a similar phenomenon did not seem to apply in the case of grysbok and duikers.

Oesophagostomum venulosum

The geographic distribution of this parasite is mainly limited to the southern and south-western Cape Province (Horak, 1987; Reinecke *et al.*, 1987) but it does extend into the Valley Bushveld regions of the eastern Cape province (Horak, 1987). It seems to prefer sheep rather than goats as hosts (Horak, 1987), and may also be encountered in cattle (Evans, Horak & Williams, unpublished data, 1986). The very small numbers recovered from the goats on 'Brakhill' preclude the possibility of determining the suitability of the antelope as hosts of these parasites.

Ostertagia spp.

Ostertagia harrisi has been described from bush-buck, *Tragelaphus scriptus*, from the northern regions of Natal (Le Roux, 1930). It has since been found in several browsing antelope species, including bushbuck, from the eastern part of the Transvaal and northern and southern Natal (Boomker, Keep, Flamand & Horak, 1984; Boomker *et al.*, 1987).

Ostertagia ostertagi infests cattle (Levine, 1980; Reinecke, 1983; Lichtenfels, Pilitt & Lancaster, 1988), and the small numbers recovered from the goats and its absence in the antelope indicate that this nematode has a limited host range. Despite the fact that Williams (1988) successfully infested goat kids with *Ostertagia ostertagi*, he concludes that his experiments do not support a well-adapted or stabilized association between goats and this helminth.

Setaria scalprum

This filarid was originally described from the steenbok, *Raphicerus campestris*, from the Kalahari

(Von Linstow, 1908). Yeh (1959) found the same worms, also in steenbok from South Africa, and Ortlepp (1961) recorded them from oribi, *Ourebia ourebi*. Boomker *et al.* (1984) found *Setaria scalprum* in red duiker, *Cephalophus natalensis*, in Natal. Little is known about this parasite but it appears to occur mainly in the smaller antelope species. The vector is assumed to be a haematophagous insect, and one could deduce that these vectors, like their hosts, are widespread in this country.

Skrjabinema spp.

These are reputedly non-pathogenic nematodes that sometimes occur in large numbers in various grazing antelope species (Horak, 1978a; Boomker, Horak & De Vos, 1986; Boomker, Flamand, Keep & Horak, 1989). Their presence in grysbok and not in the duikers confirms their preference for grazing antelope.

The goats, and particularly the Angora goats, were also infested with large numbers of *Skrjabinema*, but no specific identification was made.

Teladorsagia spp.

Teladorsagia circumcincta and *Teladorsagia trifurcata* are both recognized nematode parasites of sheep and goats (Levine, 1980; Reinecke, 1983; Lichtenfels *et al.*, 1988). However, in South Africa *Teladorsagia trifurcata* never seems to be as prevalent or as abundant as *Teladorsagia circumcincta* (Barrow, 1964; Rossiter, 1964; Muller, 1968; Horak, 1987; Reinecke *et al.*, 1987), thus conforming to the concept of major and minor species as described by Lichtenfels *et al.* (1988). The small numbers of *Teladorsagia circumcincta* recovered only from 1 grysbok and 2 common duikers, compared with the high prevalence of infestation and relatively large numbers of parasites in the goats, indicates that the antelope are accidental hosts.

It is generally accepted that *Teladorsagia circumcincta* prefers a temperate climate and high rainfall (Levine, 1980; Reinecke, 1983). Its recovery from animals in Valley Bushveld, where summer temperatures may be very high and rainfall low (Fig. 1), is thus surprising.

Trichostrongylus spp.

Trichostrongylus axei is an abomasal parasite of domestic livestock (Levine, 1980; Horak, 1981; Reinecke, 1983), while *Trichostrongylus thomasi* seems to fulfil this role in herbivorous wild animals (Round, 1968; Horak, Meltzer & De Vos, 1982; Horak, Brown, Boomker, De Vos & Van Zyl, 1982; Horak, De Vos & Brown, 1983; Horak, Boomker, De Vos & Potgieter, 1988). *Trichostrongylus axei* is, however, fairly frequently encountered in wild herbivores that come into contact with domestic stock (Horak, 1978a and b) and has previously been encountered in common duikers in this situation (Boomker *et al.*, 1983). Its absence in grysbok might imply that these animals are less susceptible to infestation.

Trichostrongylus deflexus is a parasite of several antelope species (Boomker & Reinecke, 1989). The very small numbers recovered in the present survey probably indicate an unsuitable environment for the free-living stages rather than insusceptibility of the hosts.

Trichostrongylus falculatus is found mainly inland in fairly arid regions (Horak, 1981), where it may infest sheep (Viljoen, 1964, 1969); springbok, *Antidorcas marsupialis* (Horak, Meltzer & De Vos,

1982; De Villiers, Liversidge & Reinecke, 1985); blesbok, *Damaliscus dorcas phillipsi* (Horak, 1978a) and impala (Horak, 1978b).

Trichostrongylus pietersei was originally described from sheep and Angora goats from the Karoo (Le Roux, 1932). However, its preferred habitat seems to be the eastern and south-western Cape Province, where it is encountered in sheep (Rossiter, 1964; Muller, 1968) and goats (Horak, 1987). The greater percentage of grysbok infested and the higher mean burdens than in either of the goat breeds in the present survey suggest that grysbok are a preferred host.

Trichostrongylus rugatus is a parasite of sheep and goats in the Karoo (Viljoen, 1964; Horak, 1987) and Valley Bushveld (Horak, 1987) and in sheep on natural or artificial pastures in the eastern and western Cape Province (Barrow, 1964; Rossiter, 1964; Horak, 1987; Reinecke *et al.*, 1987). On farms in Valley Bushveld near Grahamstown, it may even be the dominant parasite in sheep and goats (Horak, 1987). Its abundance and prevalence in the grysbok and the 2 goat breeds indicate that they all are good hosts, even though the worm burdens were never large.

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