Onderstepoort J. vet. Res. 45, 1–6 (1978)

PARASITES OF DOMESTIC AND WILD ANIMALS IN SOUTH AFRICA. V. HELMINTHS IN SHEEP ON DRYLAND PASTURE ON THE TRANSVAAL HIGHVELD

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ABSTRACT

HORAK, I. G., 1978. Parasites of domestic and wild animals in South Africa. V. Helminths in sheep on dryland pasture on the Transvaal Highveld. *Onderstepoort Journal of Veterinary Research*, 45, 1–6 (1978).

The seasonal incidence of helminth infestation on a farm in the Transvaal Highveld was determined by the slaughter of tracer lambs exposed on pasture for periods of approximately 6 weeks.

Haemonchus contortus, the most prevalent nematode, was recovered in the greatest numbers from January–May 1974. Peak counts of *Ostertagia circumcincta* were made during March and April 1974 and in January 1975, while *Trichostrongylus* spp. were mainly encountered from March–June. *Cooperia* spp. were generally recovered from November–May and *Moniezia expansa* from October–April.

H. contortus, *O. circumcincta* and *Cooperia* spp. all exhibited increasing degrees of arrested development in the 4th larval stage from February–June.

Résumé

PARASITES DES ANIMAUX DOMESTIQUES ET SAUVAGES EN AFRIQUE DU SUD. V. HELMINTHES DU MOUTON SUR PÂTURAGES SECS DES HAUTS PLATEAUX DU TRANSVAAL

On a déterminé la frequence saisonnière de l'infestation helminthique du mouton dans une ferme des hauts plateaux du Transvaal en sacrifiant des agneaux indicateurs mis en pâture pour des périodes d'environ 6 semaines.

Le nématode le plus abondant, Haemonchus contortus, *a présenté les charges les plus fortes de janvier à mai* 1974. *Les comptages d'*Ostertagia circumcincta *ont eu leurs sommets en mars et avril* 1974 *et en janvier* 1975, *tandis que les espèces de* Trichostrongylus *ont été rencontrées principalement de mars à juin. En général les espèces de* Cooperia *ont été récupérées de novembre à mai, et* Moniezia expansa *d'octobre à avril.*

H. contortus, O. circumcincta *et* Cooperia *spp. ont tous manifesté des degrés croissants de développement arrêté au 4e stade larvaire de février à juin.*

INTRODUCTION

The seasonal fluctuations of helminth populations in sheep grazing irrigated pastures at Hennops River were determined in a previous survey (Horak & Louw, 1977). The fact that most of the woolled sheep population of the Transvaal is grazed on dryland pastures on the Eastern Transvaal Highveld determined the area for a survey of helminths and *Oestrus ovis* larvae in sheep.

This paper reports the helminthological findings, while those for *O. ovis* are recorded separately (Horak, 1977).

MATERIALS AND METHODS

Locality

This survey, conducted on the farm "Houtenbek" near Tonteldoos (25°19′S; 29°59′E; Alt. 1 676 m) in the Dullstroom District of the Transvaal Highveld, was carried out as part of a production trial in sheep which is reported elsewhere (Horak, Honer & Schröder, 1976).

Flock lambs

During the survey, helminth infestation was maintained on the pastures by a group of approximately 90 lambs of both sexes which were treated with rafoxanide and thiabendazole on 18 May 1973 when they were approximately 2½ months old and not again. These lambs, designated flock lambs, grazed with a flock varying in number between 400 and 950 lambs. Ninety of these lambs were treated with cambendazole or thiabendazole and rafoxanide at 28-day intervals and the remainder with cambendazole during August and October 1973, thiabendazole during December 1973, May, August and October 1974 and rafoxanide during November 1973, February, April, June and November 1974.

Received 13 October 1977—Editor

Husbandry and pastures

All the lambs were weaned on 26 July 1973 and transferred to a small camp planted to Kikuyu grass (*Pennisetum clandestinum*) where their diet was supplemented with lucerne hay and maize meal. On 19 September they were put out on an *Eragrostis curvula* pasture from which, after being inoculated against enterotoxaemia, they were moved on 17 October 1973 to a pasture consisting of natural veld grasses. On 29 May 1974 they were shifted to a rested *Eragrostis curvula* pasture whence they were returned to the Kikuyu camp on 19 July. They were again put out on natural pasture on 3 October 1974 where they remained until the conclusion of the survey.

Faecal samples, from the same 10 ewe- and 10 ram-lambs from amongst the flock lambs, were collected and examined for nematode eggs at 14-day intervals and faecal cultures were made for larval differentiation.

Tracer lambs

Three lambs born and raised under worm-free conditions were treated at 4-weekly intervals with thiabendazole and rafoxanide and housed indoors for the next 4 weeks to prevent re-infestation. From July 1973–November 1974 these groups of 3 lambs were placed with the lamb flock at Tonteldoos at approximately 28-day intervals and removed after 42 days, thus allowing an overlap of 14 days between successive groups.

After removal from the pastures, the lambs were housed under worm- and oestrid-free conditions and starved for 24–48 hours prior to slaughter.

Helminth recovery

Helminths were recovered by the methods used in the earlier survey (Horak & Louw, 1977).

TABLE 1 The mean worm burdens of the tracer lambs

Date slaughtered	Mean numbers of worms recovered												
	H. contortus		*O. circumcincta*		*Trichostrongylus* spp.				*Cooperia* spp.			*Trichuris* spp.	*M. expansa*
	4th	Adult	4th	Adult	4th	*T. axei*	*T. col.*	*T. rug.*	4th	*C. pect.*	*C. punct.*	Total	Scolices
1973													
22 May*	0	9	0	0	0	0	3	0	0	1	1	6	0
24 Aug.	0	0	0	0	0	0	1	0	0	0	0	26	0
21 Sept.	0	0	0	0	0	0	0	0	0	0	0	149	0
19 Oct.	1	0	0	0	0	0	1	0	0	0	0	46	3
16 Nov.	1	22	0	0	1	18	2	6	0	8	1	5	8
14 Dec.	5	26	0	0	0	3	0	16	1	1	1	9	2
1974													
14 Jan.	34	199	2	11	4	0	2	22	3	14	4	3	6
8 Feb.	696	920	9	39	6	7	40	4	5	26	19	3	50
7 March	1 428	1 293	43	58	25	47	163	53	28	67	3	8	10
5 Apr.	2 846	1 835	113	57	4	68	94	38	24	9	7	10	7
3 May	392	21	38	20	38	28	25	45	44	12	9	5	1
30 May	119	9	40	47	6	18	63	138	0	0	2	9	1
28 June	87	1	38	2	12	23	51	109	1	1	0	7	1
9 Aug.	27	3	36	4	0	3	10	71	1	0	0	7	0
6 Sept.	36	2	52	13	0	3	11	10	0	1	0	1	0
23 Sept.	60	8	42	13	1	2	2	9	0	0	0	5	1
21 Oct.	25	14	10	43	1	0	2	1	0	1	0	9	6
18 Nov.	0	86	1	43	6	54	0	4	37	43	7	10	3
17 Dec.	5	48	0	9	6	7	1	12	8	38	16	3	2
1975													
17 Jan.	64	626	1	107	2	17	4	42	4	34	9	6	3

4th=Fourth stage larvae, *T. col.* =*T. colubriformis*, *T. rug.* =*T. rugatus*, *C. pect.* =*C. pectinata*, *C. punct.* =*C. punctata*

* Two flock lambs

TABLE 2 The percentages of *H. contortus* and *O. circumcincta* in the 4th stage of larval development

Month	No. of sheep	Mean total worm burdens			
		H. contortus		*O. circumcincta*	
		Total	% 4th stage	Total	% 4th stage
1973					
Nov.	3	23	4,3	0	—
Dec.	3	31	16,1	0	—
1974					
Jan.	2	233	14,6	13	15,4
Feb.	3	1 616	43,1	48	18,8
Mar.	3	2 721	52,5	101	42,6
Apr.	3	4 681	60,8	170	66,5
May	5	242	94,4	75	51,9
June	3	88	98,9	40	95,0
July	—	—	—	—	—
Aug.	2	30	90,0	40	90,0
Sept.	3	58	89,1	58	77,1
Oct.	3	39	64,1	53	18,9
Nov.	3	86	0,0	44	2,3
Dec.	2	53	9,4	9	0,0
1975					
Jan.	3	690	9,3	108	0,9

General

Daily minimum and maximum atmospheric temperature and rainfall were not recorded. Rain generally falls from September–May and registers an average of 850 mm. Because of the higher altitude, atmospheric temperatures are considerably lower than those recorded at Hennops River by Horak & Louw (1977).

Results

A number of the tracer lambs died as they failed to adapt to the conditions on the pastures, and consequently, on certain occasions, only 1 or 2 lambs were available for necropsy.

The mean worm burdens of each set of tracer lambs are summarized in Table 1.

The mean monthly total burdens of *Haemonchus contortus* and *Ostertagia circumcincta* and the percentage of these worms in the 4th stage of larval development from November 1973 onwards are summarized in Table 2.

The mean monthly faecal worm egg counts and differential egg counts of the untreated flock lambs are presented in Fig. 1.

Very few parasites were recovered either from the 2 flock lambs slaughtered in May before the survey or from the first 3 groups of tracer lambs. *Trichuris* spp., however, were recovered in fair numbers from the lambs slaughtered during September and October.

Haemonchus contortus: Total worm burdens increased in the lambs slaughtered from December 1973 onwards and, having reached a peak during April 1974, declined rapidly. They rose again during January 1975 when the survey ended. Adult worms predominated in the worm burden from November 1973–February 1974 and again from November 1974–January 1975, and 4th stage larvae from March–October 1974, the latter reaching their highest proportion of the total worm burden during June.

The peak reached by the faecal worm egg counts during April 1974 was followed by a steady decline until August, after which the numbers rose to another peak in December.

Ostertagia circumcincta: This nematode was first encountered in lambs slaughtered during January 1974, and thereafter in every lamb slaughtered. Peak burdens were recovered during March and April 1974, and January 1975, and adult worms predominated from January–March 1974 and from October 1974–January 1975, and 4th stage larvae from April–September 1974.

Larvae were recovered from the faecal cultures from January–October 1974. Peak egg counts were recorded during January 1974.

Trichostrongylus spp: The following 3 species of this nematode were recovered: *Trichostrongylus axei, Trichostrongylus colubriformis* and *Trichostrongylus rugatus*. The counts rose erratically from November 1973 to reach a peak from March–June 1974 and declined thereafter to a low level during October.

Cooperia spp: *Cooperia pectinata* and *Cooperia punctata* were recovered, the former species being more numerous than the latter, although both were recovered in small numbers only. No *Cooperia* spp. larvae were recovered from the faecal cultures made from the flock lambs.

Trichuris spp: *Trichuris globulosa* and *Trichuris ovis* were recovered erratically throughout the survey period. The largest numbers were encountered during September 1973 when the lambs were confined to a small paddock planted to Kikuyu grass.

Other nematode genera: *Nematodirus spathiger, Strongyloides papillosus, Oesophagostomum columbianum* and *Skrjabinema* spp. were recovered in small numbers from individual sheep.

Moniezia expansa: This cestode was present in practically every lamb slaughtered from October 1973–April 1974, and from October 1974 until the conclusion of the survey in January 1975. Of the 13 lambs slaughtered between May and September 1974, the only 4 lambs found to be infested harboured one worm each.

Avitellina centripunctata: Two of the 3 lambs slaughtered during February 1974, all 3 lambs examined during September of the same year, and one lamb slaughtered during January 1975 were infested. No other lambs were infested.

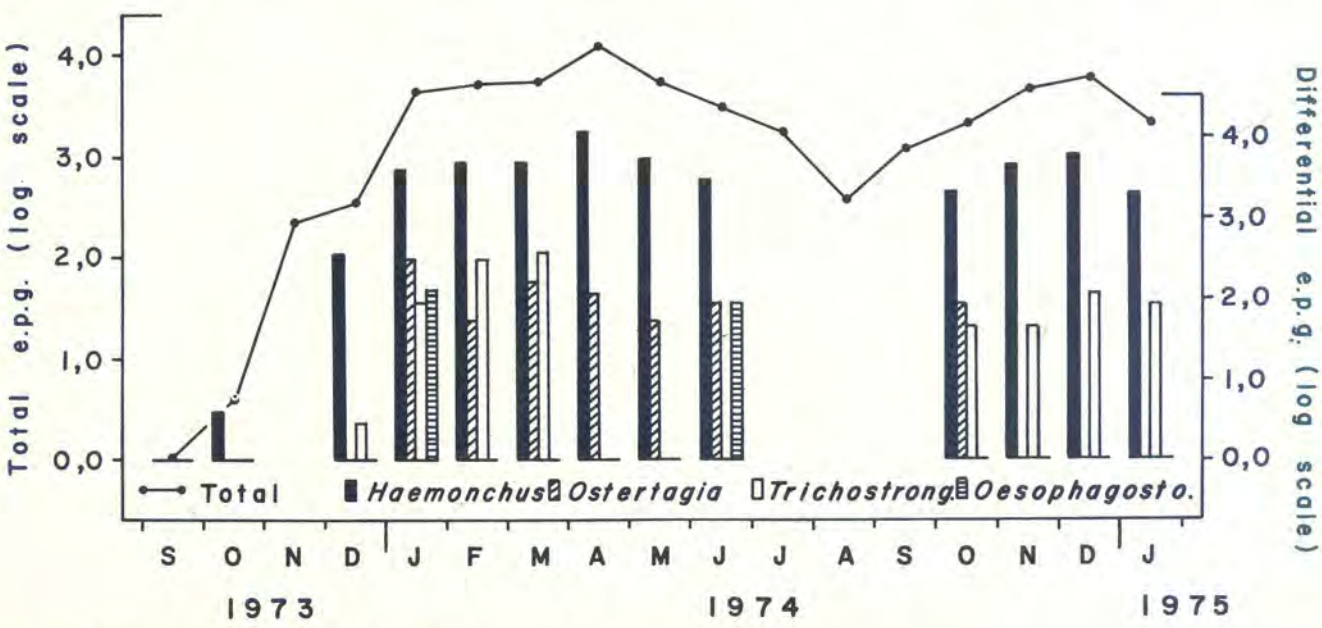

FIG. 1 Total and differential faecal worm egg counts of the untreated flock lambs

Discussion

The chief difference between the survey conducted at Hennops River (Horak & Louw 1977) and the present one is that, whereas the former survey was conducted so that man-induced interference had a minimal effect on helminth acquisition, the sheep in this survey were subjected to normal husbandry practices dictated by weaning and seasonal availability of grazing.

The most striking effects of these husbandry practices were evident in the tracer lambs slaughtered prior to January 1974. The anthelmintic treatment of all the flock lambs and their dams during May 1973 and the frequent alternation of paddocks prevented the build-up of pasture contamination. The eggs of *Trichuris* spp., however, are resistant to adverse conditions (Soulsby, 1965) and probably survived in the Kikuyu paddock after the removal of a previous batch of sheep. As this paddock was small and the grazing short, ideal conditions for the acquisition of *Trichuris* spp. infestation were created (Farleigh, 1966) as the worm burdens of the tracer lambs that grazed this paddock during July–September 1973 indicated. This phenomenon was not repeated in the following year, however, when the lambs again grazed this camp.

Despite the fact that the flock lambs had high faecal egg counts from January–May 1974 and had grazed only one paddock during this time, the tracer lambs slaugthered on 3 May and 30 May had failed to acquire large infestations. The movement of the flock lambs to fresh pastures during May and July 1974, when faecal egg counts were still fairly high, also failed to result in severe pasture contamination, judging by the worm burdens of the tracer lambs. This is largely because *H. contortus* accounted for most of the faecal egg counts and this parasite is unable to develop to the infective stage on pasture during winter in parts of the Transvaal (Horak & Louw 1977).

It should also be noted that, despite the fact that the flock lambs had egg counts due to *H. contortus* in excess of 2 000 e.p.g. from October 1974 onwards, the tracer lambs failed to acquire significant burdens of this species until January 1975 even though the flock had been grazing the pasture since the beginning of October 1974. The inability of *H. contortus* larvae to survive on pasture during spring and early summer is probably due to climatological stresses as Southcott, Major & Barger (1976) suggested.

The similarity in the acquisition of *H. contortus* infestation by the tracer lambs at Tonteldoos, where no irrigation is applied to the pastures, and Hennops River, where year-round irrigation is practised (Horak & Louw 1977), begs the supposition that, provided moisture is adequate, temperature and solar irradiation are of major importance for the survival of larvae.

H. contortus infestations were high at Hennops River until May or June, but only until April at Tonteldoos, a phenomenon which may well be due to the cooler climate at the latter venue. The earlier protection against solar irradiation afforded by the more rapidly growing irrigated pastures at Hennops River would account for the infestations there from December onwards, whereas they were evident at Tonteldoos only from January.

The pattern of acquisition of *O. circumcincta, Trichostrongylus* spp. and *M. expansa* at the 2 localities was nearly identical although the irrigation and consequently better pasture cover at Hennops River resulted in higher burdens of all these species (Horak & Louw 1977). A striking observation at both Tonteldoos and Hennops River was that the period August–November is unfavourable for the development of *H. contortus* and relatively unfavourable for *Trichostrongylus* spp. on the pastures, whereas *O. circumcincta* is encountered in fair numbers during this time.

The availability of *Cooperia* spp. infestation was largely confined to the period November–May. These nematodes were probably of cattle origin as cattle grazed before or with the sheep.

The only *M. expansa* infestations of any note after the winter were encountered in the lambs slaughtered during October. The ingestion of mites in which cysticercoids had overwintered would have accounted for these infestations. The level of infestation remained fairly high until April and virtually disappeared during the winter as development of the cysticercoid in the mite is retarded by cooler temperatures (Kuznetsov, 1970).

The phenomenon of arrested development, as reviewed by Michel (1974), had the effect of retarding the development of *H. contortus, O. circumcincta* and *Cooperia* spp. in the 4th larval stage during the winter months. The degree of inhibition and the months during which it was present were virtually identical with those for the former 2 species at Hennops River (Horak & Louw 1977). However, the fact that *O. circumcincta* exhibited greater inhibition during June and August at Tonteldoos than at Hennops River was probably the result of the colder winters in that district, and overwintering within the host as hypobiotic 4th stage larvae is thus essential for its survival.

The faecal worm egg counts of *H. contortus* in the flock lambs are corroborative evidence for the hypothesis of overwintering. From September 1973–April 1974, the counts closely followed the ever increasing numbers of worms acquired by the tracer lambs. The subsequent drop in egg count is due both to self-cure (Stewart, 1953) and aging of the adult population as little further infestation was acquired from the pastures. The sustained rise in egg counts from September–December 1974 cannot be accounted for by any recent acquisition of infestation, as the tracer lambs by that time were picking up very few larvae from the pastures (Table 1), but is due rather to the maturation of 4th stage larvae which had been acquired during the autumn and winter (Blitz & Gibbs, 1972). These larvae had remained in this stage of development as a result of arrested larval development in the sheep during the winter months when conditions outside would have been unfavourable for survival (Muller, 1968).

Gstertagia circumcincta had not previously been recovered from sheep on dryland pastures in the Transvaal Highveld. Thomas (1968) makes no mention of it in his surveys in this region when he used faecal worm egg counts and cultures as survey tools. The small numbers recovered in the present survey and the low egg-laying capacity of this worm (Kauzal, 1933) indicate that it could easily be missed when egg counts and faecal cultures alone are used in surveys.

Acknowledgements

I wish to thank MSD (PTY) LTD for providing the tracer lambs for this survey and the laboratory staff of the MSD Research Centre, Hennops River, for their assistance with the necropsies. I am grateful, too, to Mr B. O'Grady for the facilities he provided on the farm, "Houtenbek".

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