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Source: Journal of Wildlife Diseases, 15(3) : 399-404

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-15.3.399>

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EXPERIMENTAL TRANSMISSION OF GASTRO-INTESTINAL NEMATODES BETWEEN SHEEP (*Ovis aries*) AND THOMSON'S GAZELLES (*Gazella thomsonii*) ^{□ □}

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Abstract: Experimental cross-transmission of gastro-intestinal nematodes between Merino sheep (*Ovis aries*) and Thomson's gazelles (*Gazella thomsonii*) from similar but separate grazing habitats in Kenya was studied. Cross-transmission did occur with some species but the faecal egg counts of sheep were higher than the gazelles' following infection with larvae isolated from either sheep or gazelles.

Of the 11 gastro-intestinal nematodes which became established in gazelles following infection with larvae cultured from nematodes in gazelles, only *Haemonchus contortus*, *Trichostrongylus probolurus* and *Cooperia hungi* were infective for sheep.

Following infection with larvae of either sheep or gazelle origin, the *H. contortus* recovered from the sheep at necropsy were more numerous and had greater average weights, lengths and spicule lengths than those recovered from the gazelles. This would suggest that *H. contortus* is primarily a sheep parasite.

It is concluded that Thomson's gazelles probably would not contribute significantly to the problem of haemonchosis in sheep in areas of shared grazing, unless efforts were being made to eradicate the parasite from sheep, in which case the gazelles would act as a continuing reservoir of infection.

INTRODUCTION

Taxonomic criteria indicate that African wild ruminants and domestic livestock share several gastrointestinal helminth species but the possible role of the wild ruminants as a source of infection for domestic stock remains purely speculative. The only previous reports of experimental work in this field have been the infection of sheep with larval cultures from the faeces of impala (*Aepyceros melampus*), blesbok (*Damaliscus dorcas*), springbok (*Antidorcas marsupialis*), waterbuck (*Kobus ellipsiprymnus*) and kudu (*Tragelaphus*

strepisiceros).^{4,5,6,7} In these experiments *Haemonchus*, *Trichostrongylus* and, to a lesser extent, *Strongyloides*, *Impalalia* and *Oesophagostomum* spp. became established in the sheep.

Since helminthiasis is probably the greatest single impediment to the development of sheep and goat production in the tropics, knowledge of the extent to which cross-infection occurs between domestic and wild ruminants is important in the formulation of helminth control programmes in areas where the various species coexist. However, there are no reports of controlled experiments

[□] Research conducted as part of a Kenya Government project supported by the Canadian International Development Agency through the International Development Research Centre.

[□] Published with the approval of the Director of Veterinary Services, Kenya.

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to determine the cross infectivity of "wild strains" of helminths for domestic ruminants in Africa. One of the game species which most commonly shares grazing with sheep and goats in Kenya is the Thomson's gazelle (*Gazella thomsonii*). In areas where the gazelle is found the overall ratio of smallstock domestic ruminants to Thomson's gazelles is approximately 13:1 (W. Stevens, pers. comm.).

The present investigation was carried out to establish the degree of cross-infection between Merino sheep (*Ovis aries*) and Thomson's gazelles, using larvae cultured from naturally-infected animals of both species.

MATERIALS AND METHODS

The Thomson's gazelles were obtained from Suguroi Estate, a sheep and cattle ranch on the Laikipia Plateau of Kenya.¹ The location of the ranch is in a savannah area at about 0°, 7'N and 36°, 35'E, at an elevation of 2000 - 2200 m. About 11,000 sheep and 1,500 cattle are grazed on 9,150 ha of the ranch, enclosed by sheep and gazelle-proof fencing. The number of Thomson's gazelles ranges between 1,500 and 2,000. Lesser numbers of Grant's gazelles (*Gazella granti*), impala (*Aepyceros melampus*) and steinbuck (*Raphicerus campestris*) are present. The 11 gazelles used for experimental infection were captured outside the paddocks, on land grazed by cattle but not sheep; this location was selected so that recent acquisition of sheep parasites would not have occurred.

The Merino sheep, which originated from a similar area, had been reared on helminth-infected pasture according to normal commercial management practice.

All the animals were treated with levamisole \square and thiabendazole \square and

maintained indoors in nematode-free conditions for 3 months prior to experimental infection. During this period their nematode-free status was regularly checked by faecal examination.

Faeces were collected from Merino sheep grazing inside and fresh faeces from gazelles were collected from just outside the fenced paddocks. Larval cultures were prepared and maintained in the natural host for one passage before being used for experimental infection.

Initially 8 Thomson's gazelles and 7 Merino sheep were orally infected with larvae from the sheep culture at a rate of 200 larvae/kg bodyweight. Faecal samples for egg counting were collected twice-weekly for 8 weeks. Four weeks after infection two animals of each species, with faecal egg counts representative of the group mean, were examined at necropsy and all the intestinal helminths were collected for identification and counting.²

In the next experiment, 7 gazelles and 9 Merino sheep were orally infected at a rate of 200 larvae/kg bodyweight with the larval culture isolated from the gazelles. Faecal samples were collected twice-weekly for 9 weeks and at 4 weeks after infection two animals of each group were examined at necropsy and processed as before.

Adult *H. contortus*, which had been fixed in alcohol after collection, were weighed¹ and the spicule lengths measured.

RESULTS

Observations in sheep and gazelles exposed to larvae cultured from sheep

The faecal egg counts of the Thomson's gazelles and the Merino sheep infected with larvae cultured from the sheep are

\square Nilverm, Imperial Chemical Industries, Alderley Edge, England.

\square Thiabendazole, Merck Sharp & Dohme, Hoddesdon, England.

shown in Figure 1. The faecal egg counts from the sheep were considerably higher than those from the gazelles, reaching a maximum of 27,000 eggs per gram (epg) at 35 days after infection and maintained a level of around 20,000 epg until the end of the study. The egg counts of the gazelles, however, did not exceed 2,000 epg and had returned almost to zero at 55 days after infection.

H. contortus was the only gastrointestinal helminth recovered from either species at necropsy. When calculated as a percentage of the larval dose administered, the recovery from the sheep was 24.2% while that from the gazelles was 2.9%. The mean spicule length in the sheep specimens was 461 μm compared with 422 μm in the gazelles. Marked differences in the nematode weights and lengths also were recorded; i.e., 1.02 mg and 0.18 mg; and 19.21 mm

and 11.15 mm in the sheep and gazelles, respectively.

Observations in sheep and gazelles exposed to larvae cultured from gazelles

The faecal egg count data from both species are illustrated in Figure 1. Although the counts were in both cases lower than with the sheep strain, sheep again had higher counts than gazelles. Faecal egg counts from sheep reached a maximum of 3000 epg at 50 days after exposure to larvae whereas those from the gazelles increased to 1500 epg at 23 days after infection and progressively declined to a value of 200 epg at the termination of the study.

Nematode burdens at necropsy, expressed as a percentage of the larvae inoculated, are shown in Table 1. Despite having lower faecal egg counts, the

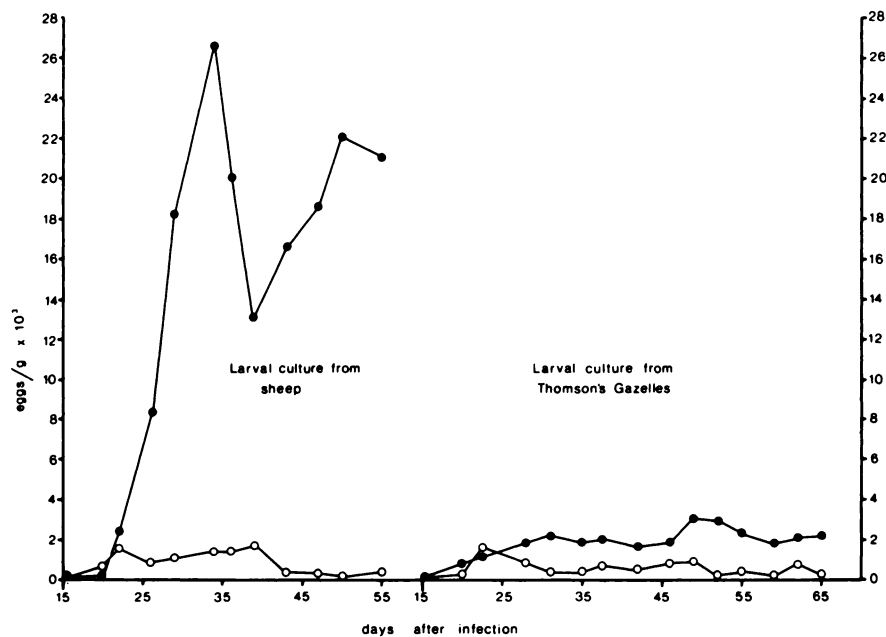


FIGURE 1. The faecal egg counts of Merino sheep and Thomson's gazelles, following infection with larvae cultures from sheep or gazelle faeces, at an infection rate of 200 larvae/kg body weight. ● Merino sheep; ○ Thomson's gazelles.

TABLE 1. The adult nematodes recovered, expressed as a percentage of the larval dose (200 larvae/kg bodyweight) from Thomson's gazelles and Merino sheep following infection with larvae cultured from Thomson's gazelle's faeces.

| Parasite | Thomson's gazelle | Merino sheep |
|-------------------------------|-------------------|--------------|
| <i>Haemonchus contortus</i> | 1.54 | 3.86 |
| <i>Trichostrongylus axei</i> | .06 | — |
| <i>T. colubriformis</i> | .44 | — |
| <i>T. probolurus</i> | 7.00 | .09 |
| <i>Cooperia fuelleborni</i> | .04 | — |
| <i>C. hungi</i> | 2.10 | .01 |
| <i>C. verrucosa</i> | .04 | — |
| <i>Paracooperia racipheri</i> | .02 | — |
| <i>P. serrata</i> | .46 | — |
| <i>Impalalia nudicollis</i> | .96 | — |
| <i>Trichuris spiricollis</i> | 2.27 | — |
| TOTAL | 14.06 | 3.96 |

gazelles had a mean percentage nematode return of 14.06% compared with 3.9% in the sheep. Of the 11 nematode species found in the gazelles, only three were isolated from the sheep. Recoveries of *Trichostrongylus probolurus* and *Cooperia hungi* from the sheep were much lower than in the gazelles but there was a greater establishment of *H. contortus*. In addition, the mean spicule lengths of the *H. contortus* specimens were 456 μm in the sheep and 435 μm in the gazelles. The weights and lengths of *H. contortus* were 0.93 mg and 0.16 mg; and 18.13 mm and 12.28 mm from the sheep and gazelles, respectively.

DISCUSSION

The results of these experiments demonstrate that cross-infection with some species of intestinal nematodes can occur between Merino sheep and Thomson's gazelles. Although *T. axei*, *T. colubriformis* and *I. nudicollis* have been isolated previously from sheep in Kenya they were among the eight nematode species which became established in the gazelles and not in the sheep, following infection with larvae of gazelle origin. This could be explained by the sheep's

immunity as a result of previous exposure to the parasites. However, as the animals were totally refractory to infection, after three months in a worm-free environment, it is more probable that the nematode strains were adapted to the Thomson's gazelle and were not infective for sheep.

When infected with larvae from either source, sheep had consistently higher faecal egg counts than gazelles. Moreover sheep have a daily faecal output almost 20 times greater than Thomson's gazelles. The higher faecal egg counts of the sheep which occurred, despite the heavier nematode burdens in the gazelles in the second study, probably were the result of differences in the establishment of *H. contortus*, the species considered to be the most fecund of the gastrointestinal nematodes. In the sheep the percentage and establishment, weights, lengths and spicule lengths of *H. contortus* were all greater than in the gazelles irrespective of the source of larvae. Furthermore, faecal egg counts of the sheep persisted at a high level throughout, whereas in the gazelles counts declined to almost zero at 60 days after infection, possibly associated with the expulsion of adult parasites after

patency. All these factors would suggest that the gazelles had developed a better acquired immunity to reinfection with *H. contortus* or that the *H. contortus* isolated from both the sheep and gazelles was primarily a sheep parasite although gazelles could become infected and act as a reservoir host.

In the paddocks on Suguroi Ranch both sheep and gazelles graze areas of short grass, predominantly *Cynodon dactylon* and *Pennisetum stromineum*. The potential for cross transmission between the species would therefore appear to be good, but the results of this study indicate that the Thomson's gazelle is probably of minor importance in the epidemiology of *H. contortus* in an extensive mixed grazing situation with sheep. Similarly the establishment of *C. hungi* and *T. probolurus* in sheep was only about 1% of that in the gazelle.

However, in a fenced situation such as described in the current study, any attempt to eradicate helminthiasis from the sheep by regular intensive anthelmintic treatment would be thwarted by the presence of Thomson's gazelles.

In a similar way, any reduction of pasture larval contamination resulting from the use of rotational grazing systems would be prevented if Thomson's gazelles were constantly grazing the paddocks.

Although these results demonstrate a low degree of cross-transmission between sheep and gazelles, it should be noted that the gazelles used in this study had never grazed together with sheep and if cultures from gazelles had been collected inside the fenced paddocks, a higher degree of adaptation of the parasites to both hosts might have been observed. In such a case the degree of cross-infection would have been greater.

Acknowledgements

We wish to thank Mr. Charles Stone-Wigg, manager of Suguroi Estate, for permitting and facilitating the research and Dr. A.M. Dunn of Glasgow University Veterinary School, for measuring the spicules.

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Received for publication 28 March 1978
