DEER PARASITE STUDIES

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This paper reports the findings of two studies undertaken recently as part of a masterate in veterinary clinical studies, to investigate a number of aspects of internal parasitism and parasite control in farmed red deer.

1. ANTHELMINTIC MEDICATED SUPPLEMENTARY FEEDSTUFF

A number of situations arise where a deer farmer may consider a need for anthelmintic treatment yet be unwilling to muster and yard his deer for drenching.

i) When late (post-rut) weaning is desired, a three-weekly drenching of 3 month old stock is risky because of potential injuries to calves during yarding, the stag is often aggressive toward other stock and handlers during the rut, and there is a possibility that disturbance of hinds during the breeding season may impair conception rates.

ii) High parasite burdens have been found in some situations before the usual weaning time (mid-March). Many farmers believe young calves are too small to risk early yarding for anthelmintic treatment.

iii) Clinical lungworm problems can occur throughout the year but most commonly in autumn - early winter. Where such problems are diagnosed in stags, oral drenching would be very dangerous.

iv) Some farmers yard and handle their deer as little as possible simply as a matter of personal preference. An alternative to drenching would be attractive to such farmers.

v) Parasites may become a problem on some farms which do not have yarding facilities.

vi) Deer in some zoo situations may not be able to be handled for drenching.

There were two reports in the overseas literature of the use of anthelmintic medicated supplementary feed. It was decided to investigate the efficacy of a similar preparation in controlling internal parasitism in red deer, under farm conditions and to compare this with oral drenching under intensive rotational grazing and set stocking systems.

Experimental design

Animals and treatment

A. Twentyfour 3½ month old red deer (16 male and 8 female) were allocated to three groups containing deer of both sexes and of equivalent body weights. Groups were subjected to the following management and treatment procedures.

Group 1. Rotationally grazed on pasture alone. Given albendazole ("Valbazen") 10mg/kg by oral drench 4 times at 3 week intervals from 21 April.

Group 2. Set stocked (32/ha). Fed 2kg non-medicated NRM deer nuts (Protein >14%; Fat >4.5%; Fibre >12%; Salt 1%) per head/day. Orally drenched as for Group 1.

Group 3. Set stocked (32/ha). Fed 2kg NRM deer nuts/head/day. On three occasions medicated nuts were given for 10 consecutive days with an interval of 21 days between treatments i.e. these deer were given approximately 100mg albendazole/day for 10 days, representing a total dose of approximately twice the oral drench dose. The quantity of nuts needed to give this dose was 0.5kg/head/day.

NOTE: Groups 2 and 3 received a minimum of 300g pasture DM/head/day in addition to the 2.0kg of nuts, constituting a minimum of 2.0kg high quality DM/head/day. Group 1 was fed ad-lib available pasture ahead of adult stock on the unit.

Groups 2 and 3 received 50mg/head/day of molybdenum sulphate to prevent copper toxicity which may have arisen when such high proportions of concentrates were given for prolonged periods.

Groups 2 and 3 needed to be split into two groups of 4 each to investigate any possible plot effect on the treatments in order to statistically validate the experiment.

Animals in all groups were weighed and faecal sampled per rectum at least weekly. The frequency of faecal sampling of Group 3 was 2-daily during application of medicated nuts.

Faecal samples were examined for *D. viviparus* larvae/gram (lpg) by a modified Baerman apparatus and for gastrointestinal nematode eggs/gram (epg). The Baermans technique used was more sensitive than the commonly used technique, therefore care must be taken in comparing the larvae counts with counts reported elsewhere.

T tests were performed to check for a plot effect on the treatments. No plot effect was evident i.e. the effect of treatment was the same for both subgroups within each treatment, so data for the subgroups of groups 2 and 3 were able to be pooled for analysis.

Statistical comparisons involving egg and larval counts and body weights were made between the three groups at three time periods: before, during and after the treatment periods. Pre, during and post-treatment effects within each group were also examined.

Results

1) Larval counts. Mean larval counts are presented in figure 1.

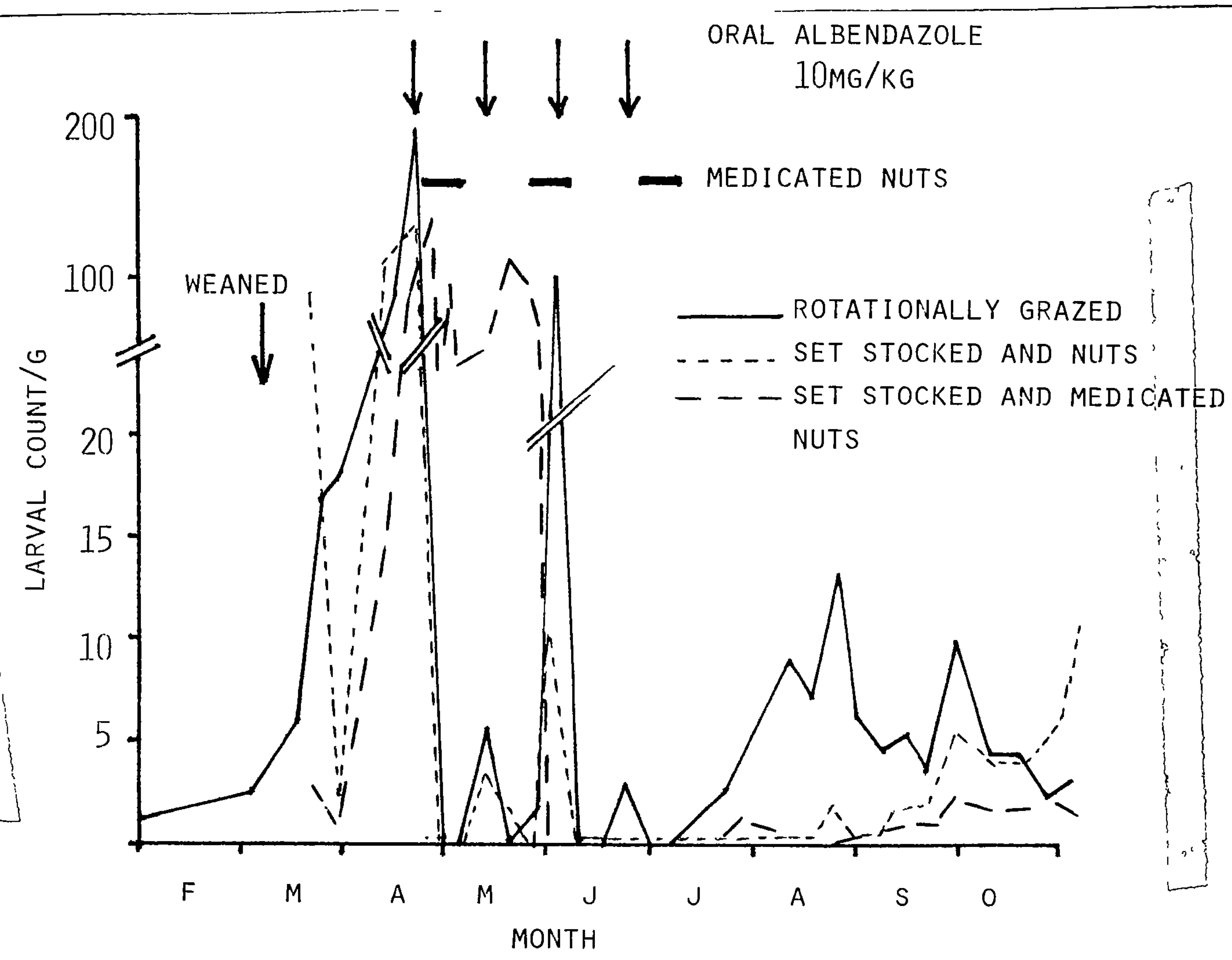

FIG. 1. MEAN FAECAL LUNGWORM LARVAE COUNTS.

Individual larval counts before treatment commenced ranged from 5-675/g by April 20. The latter figure is considered high and suggests that clinical problems would have occurred shortly afterwards had drenching not been undertaken. The prevalence of lungworm larval counts at the commencement of treatment was 100%. Larval counts in groups 1, 2 and 3 before or during treatment periods were not significantly different. Thus the oral drench and medicated nuts were equally effective in reducing larval counts.

However, it was interesting that while the first 10-day administration of medicated nuts resulted in some reductions of mean larval counts, 100% continued to excrete larvae. Further, some deer continued to excrete larvae at a similar rate despite the availability of medicated nuts. From visual observations made, it became apparent that not all deer had adapted to their full ration of nuts, thus some were consuming few, if any, medicated nuts. However, the second 10-day medicated nut treatment resulted in a reduction of larval output to zero in all cases. Thus, as would be expected, the effectiveness was related to intake. It was clear that the dose given was adequate, provided all deer consumed their allocated ration.

Before the third 10-day medicated nut treatment period, only 2 deer had larvae counts and these were only 1.2 and 3.2/g. All counts were zero after the third treatment period.

Oral drenching resulted in a dramatic fall in mean count to less than 2/g after 7 days. Only 3 of 16 deer were excreting larvae after 7 days and only 2 were excreting larvae after 14 days. 21 days after treatment 85% were excreting larvae.

This indicates that:-

i) The prepatent period of <u>D. viviparus</u> in deer may be shorter than 21 days, or ...

ii) The anthelmintic was not effective in destroying immature stages of the parasite, or ...

iii) The anthelmintic only suppressed egg laying for a period of 14-21 days without killing the parasite.

The latter is unlikely.

It was surprising that after the second oral drench larval counts did not fall as markedly as for the first drench. From data recorded elsewhere, it appears likely that the dose of anthelmintic delivered on that day may have been suboptimal. No other data on this anthelmintic has shown such a poor response in terms of either larvae or egg count: the first, third and fourth treatments resulted in considerably lower counts.

The only statistically significant difference between groups was that larval counts from rotationally grazed deer were higher than from the set stocked deer in the period after treatment - i.e. counts in the rotationally grazed group increased during the winter and spring because the consumption of pasture was approximately seven times that of the set stocked group, and thus higher reinfestation occurred from overwintered and/or recently shed larvae.

ii) Fgg counts. Mean egg counts are presented in figure 2.

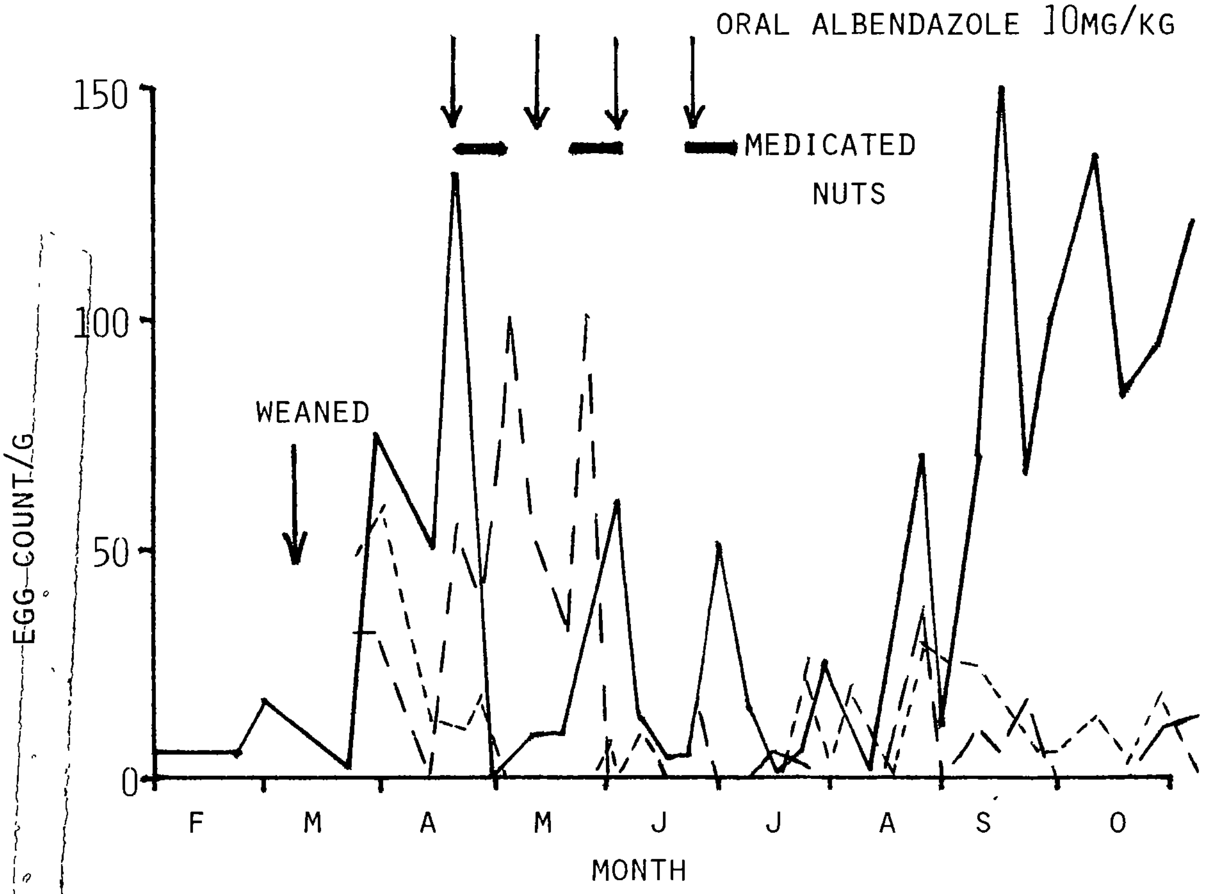

FIG. 2. MEAN FAECAL EGG COUNT: - ROTATIONALLY GRAZED; --- SET STOCKED AND NUTS; - - - SET STOCKED AND MEDICATED NUTS.

Egg counts were uniformly low during the trial: the highest count was 250/g in one deer before treatment. Only 65% of deer had egg counts prior to treatment. The pattern of change following oral drenching was similar to that of the larval counts during the treatment period: mean counts fell markedly and the prevalence of counts fell to zero after 14 days, and remained low following the next 3 drenches.

Egg counts did not fall markedly during or after the first 10-day medicated nut treatment for the reasons described earlier. Counts fell to very low levels following the second and third medicated nut treatments, but counts were not as low as in the oral drenched groups. This probably was due to the poor acceptance of nuts early in the experiment.

Egg counts in rotationally grazed deer rose to higher levels than in the set stocked deer during the winter and spring, but this difference was not statistically significant.

B. iii) Body weights. Mean weights are shown in figure 3.

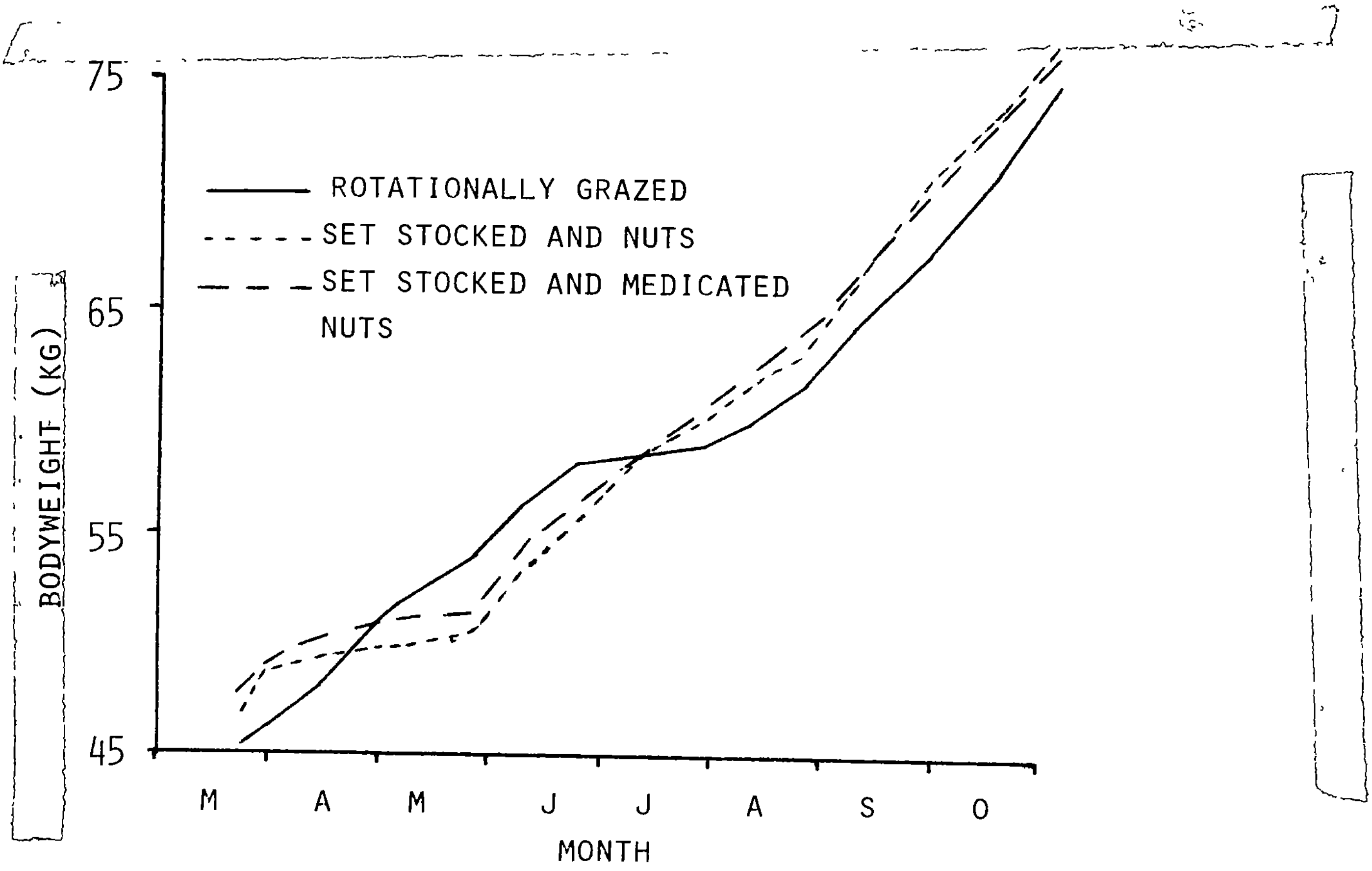

FIG. 3. MEAN BODY WEIGHTS

Growth rates were considered good, although there was a body weight gain check in the two set stocked groups during the period of adaptation to small groups and a new feedstuff on small trial plots. However, as these deer adapted to their environment and diet, their growth rate was slightly higher than for the grass fed deer until the end of June. During July, the growth rate of pasture fed deer fell and mean weights fell below the nut fed groups. However from August, growth rates were the same. At the end of the trial, the mean body weights of the groups differed by only 1.2kg - less than the 2.4kg difference at the commencement of the study.

Statistically, there were no differences in body weight gain between the three groups.

iv) Palatability of medicated nuts. It appeared there was no difference in acceptance of medicated nuts from non-medicated nuts. The difficulty arose in getting the weaners to accept the supplement *per se*. It was necessary to hold the deer in a yard for 36h and feed only nuts before all deer would accept them.

COSTS

An oral drench of albendazole at 10mg/kg costs a farmer 30c for a 50kg deer. Thus the programme of oral drenching used in this study cost $1.20 per animal.

The nut fed deer consumed 68c worth of non-medicated nuts per day at $344 per tonne. Even at 0.5kg/day the cost would be 17c/day. In total the quantity of nuts needed would approximate to 7kg during 14 days adaptation to the nuts, 15kg of medicated nuts (3 x 10 day courses), and 21kg in the intervals between treatments. Thus a minimum of 43kg of nuts would be needed per head (at 0.5kg/day) to undergo the course. The cost would be $14.79 per animal, not including the added (unknown) cost of the medicated preparation.

Thus it would appear that the use of this approach to parasite control is expensive, unless this type of supplementary feed was used on the property anyway. However, many deer farmers currently use large quantities of concentrates and the additional cost of adding the anthelmintic to the preparation may not be significantly greater than an oral drench programme.

CONCLUSIONS

- Anthelmintic impregnated nuts are effective in controlling internal parasitism in deer
- Medicated nuts are as effective as an oral drench programme
- The effectiveness requires an adaptation to the supplementary feedstuff
- There is no difference in acceptance of medicated and non-medicated nuts
- The reinfestation rate of deer following medicated nuts was no different from orally drenched deer under the same management system
- The potential use/s for such a control system are limited
- The programme is costly (nuts @ 34c/kg) unless a farmer already uses supplementary feed
- The 10 day on - 21 day off programme requires planning.

2. THE RELATIONSHIP BETWEEN FAECAL EGG COUNT AND GUT WORM COUNT

Two facts need to be established before a faecal egg count develops a quantitative meaning:

i) What is the relationship between faecal egg count and total worm burden.

ii) What is the relationship between gastrointestinal worm numbers and pathogenicity.

Combined a probability of production limiting effects of gut parasitism on the basis of faecal egg counts can be established. Knowing this, a rational parasite control programme based on monitoring can be established and a diagnosis of gastrointestinal parasitism in a scouring or illthrift deer can be made.

Experimental: 46 male red deer slaughtered at a deer slaughter premise (DSP) were used. Deer were selected at random for sampling. They were 18 months or older, and sampling was undertaken between June and October. The abomasum and intestines were collected.

Faecal samples were analysed for nematode eggs, and abomasal and intestinal worms separated, identified and counted using standard techniques.

Results and discussion

A. Total egg and worm counts

Results are summarised in Table 1.

Table 1 MEAN AND RANGE OF EGG AND WORM COUNTS

		WORM COUNTS						
	EPG	TOTAL	ABOMASAL	SI	LI	FEMALE	MALE	% MATURE
Mean*	300	2,321	2,362	30	29	1457	803	95
Range	0-1100	0-31,110	0-31,110	0-90	0-90	0-18000	0-73110	39-100
%	39	80	78	22	39	78	80	

*Means and % are of deer with counts >zero.

Number with egg count: 39% of stags had faecal egg counts of 50/g or more. It was noted that some groups of deer possessed uniformly high or low counts suggesting a between property of origin difference, as would be expected.

Number with worm counts. 80% of stags had gut worms despite the low percentage with egg counts. Thus, of the stags carrying gut worms, only 49% had detectable egg counts. This may be due to several factors:

i) Technique. The faecal egg counting technique sensitivity is 50 epg. It is likely that many deer with low parasite counts were in fact shedding eggs, but the technique was not sensitive enough. However, the total worm burdens in stags with zero egg counts ranged from 10-6310 (mean 681). Thus many deer had worm burdens well above average (2321), yet had zero egg counts.

ii) Parasite maturity. Immature parasites do not produce eggs. However, the data showed that 47% of deer with zero egg counts had a burden of 100% mature worms. An average 93% (range 39-100%) of worms in animals with zero egg counts were mature. In fact only one of 19 deer in this category had a proportion of mature worms less than 85% of the total count.

iii) Sex of parasite. Male parasites do not excrete eggs. Of deer with zero egg counts but gut worm counts, all but one had mature female worms present - i.e. only 1 deer had only male parasites.

iv) Intermittent shedding of eggs. It is possible that parasites lay eggs only intermittently. It was noted in study 1 above that the same deer could have very widely different egg counts from week to week, for no apparent reason. However, it is difficult to understand a mechanism that would stop shedding in all of 2500 parasites simultaneously.

v) Distribution of eggs in faeces. Parasite eggs are not evenly distributed through faeces. With low egg outputs this will lead to some false negative egg counts.

Total worm counts. Total counts generally were low. The average (2321 worms/deer) was elevated largely by 3 deer with total counts of 15000 or more. The highest count in all the others was 6310.

Location of worms. It is clear that the majority of parasite burdens were in the abomasum. Only 22% and 39% had worms in the small and large intestines, respectively. Significance of relative burdens unknown.

Male:female ratio. The mean count of mature female parasites (1457) was almost double the count for males (803). The reason for this discrepancy is unknown.

Parasite maturity. All deer with a parasite burden had mature parasites present. The ratio of mature:immature varied from 39-100% i.e. some deer possessed more immature than mature parasites. On average, 94.7% of parasites were mature.

B. Worm identification

Results are summarised in Table 2.

Table 2 WORM IDENTIFICATION AND NUMBERS

Abomasum	% with counts	Mean*	Range
O. leptospicularis	41	69	0-290
Spiculoptera asymmetrica	30	98	0-520
S. spiculoptera	24	42	0-160
Skrjabinagia kolchida	15	39	0-10
Sk. lyratiformis	2	10	0-140
Ostertag type L_4	39	186	0-3830
Ostertag sp. (total)	67	373	0-1210
T. axei	28	1941	0-30700
T. vitrinus	2	20	0-20
Trichostrongylus sp. (total)	56	1727	0-30700
Intestines			
Cooperia sp.	13	18	0-20
Oe. venulosum	39	29	0-90

*Mean counts excluding zero

Note: Ostertagia, Spiculopteragia and Skrjabinagia are all species of the tribe Ostertagiea and so are closely related.

O. leptospicularis was the most commonly located species (41%), Ostertagiea were located in 67% of animals. Notable by their absence were the Ostertagia species of sheep and cattle.

Trichostrongylid species were present in 56% of animals with T. axei being the major species.

Cooperia species and Oesophagostomum venulosum were present in the small intestine but only in small numbers. The common parasite species present in the intestine of sheep and cattle were not present.

C. Statistical correlation between egg and worm counts

Figure 4 describes the relationship between egg and total worm counts. The correlation ($r^2 = 0.76$) was significant ($p > 0.01$). However, the difficulty with this data is that the range of egg and worm counts is limited: no counts are considered very high, and generally counts were grouped at the low end of the scales. A further complication is the number of zero egg counts in deer with up to 6300 parasites. When used clinically for extrapolation of worm counts, it is impossible to estimate the number of immature parasites present, and thus the use of such a correlation can only aid diagnosis when egg counts are high. Similarly, some forms of gastrointestinal parasitism may involve inhibited larvae, these cannot be gauged by egg counts. Plasma pepsinogen measurements should always be considered when tests for gut parasitism are carried out.

This data cannot give information about the clinical relevance of the egg count as studies into the pathogenicity of various species burdens have not been undertaken. Establishment of this data requires either artificial inoculation of deer or investigation of clinical disease caused by parasites. It appears currently that clinical gastrointestinal parasitism is not common in deer. This is probably due to the widespread use of anthelmintics, but is affected by both grazing management and the natural resistance of the host.

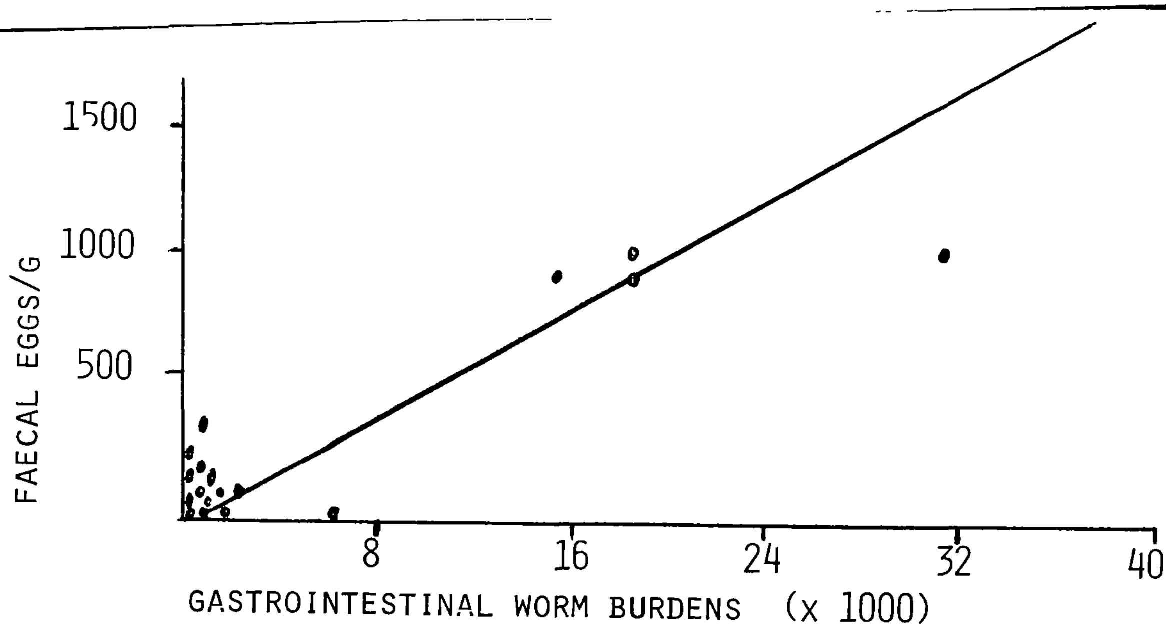

FIG. 4. THE RELATIONSHIP BETWEEN FAECAL EGG COUNT AND GASTROINTESTINAL WORM COUNT IN RED DEER ($R^2 = 0.76$, $P<0.01$)