A preliminary undifferentiated faecal egg count reduction test survey in the Caledon area

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ABSTRACT

During October 1998 a study was performed in the Caledon area to determine the presence of anthelmintic resistance in the southern Western Cape, which falls within the winter rainfall region of South Africa. The study took the form of an undifferentiated faecal egg count reduction test (FECRt) survey. The predominant worm genera of the region are *Teladorsagia* and *Trichostrongylus* , but *Haemonchus* causes occasional outbreaks in sheep. No resistance data for any area in the Western Cape Province are available at present. Resistance (< 90 % FECR) was recorded on 73 % of the farms included in the study, with 46 % of these involving resistance to 1 drench, 36 % to 2 drenches and 18 % to 3 drenches. No moxidectin resistance was detected when it was administered at the therapeutic dosage of 0.2 mg/kg. The results of this study show clearly that resistance of nematodes to other anthelmintics occurs in the Caledon area.

Key words: anthelmintic, resistance, South Africa, *Teladorsagia.*

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INTRODUCTION

Recent surveys indicate that anthelmintic resistance is reaching crisis proportions in certain areas of South Africa[11]. It appears from the surveys of Van Wyk *et al.*[11] that resistance to at least 1 anthelmintic group has been reported on all farms in the Mpumalanga and KwaZulu-Natal provinces. While surveys have shown conclusively[11] that anthelmintic resistance is prevalent and very serious in the summer rainfall regions of South Africa (where *Haemonchus contortus* is the most important nematode species in sheep), no data have been published for the winter rainfall regions of South Africa, where *Teladorsagia* and *Trichostrongylus* predominate[8]. The present survey was therefore undertaken as a preliminary investigation of the presence of anthelmintic resistance in the southern Western Cape Province.

MATERIALS AND METHODS

Farms

The fifteen farms whose owners responded to a letter posted to 70 clients of a private practitioner of Caledon were included in the study (Fig. 1).

Animals

Only Merino lambs, 3–4 months old, that had never before been treated with an anthelmintic were used in the study. Fifty lambs were held in a pen, and allowed to pass singly through a race. As the animals passed they were allocated to a test group *i.e.* the 1st was allocated to the control group, the 2nd to the 1st treatment group and so on until all animals had been allocated to 1 control and 4 treatment groups.

Anthelmintics and treatment

Four of the 5 groups were each treated with a different anthelmintic, while the 5th served as a control group, in which the sheep were drenched orally with 10 ml distilled water. Anthelmintics were administered orally and the dose for the animals in each group was calculated by weighing the three largest animals in a group and then treating that group according to the mass of the heaviest animal.

During the past 25 years, remedies from the benzimidazole, levamisole and macrocyclic lactone groups have been used in the Caledon area (I A Herbst, Overberg Veterinary Clinic, Caledon, pers. comm., 1998). All of these were used in the present study, with 1 active ingredient per group except for the last group, in which both ivermectin and moxidectin were used.

Sample collection

On the day of treatment and again 10 days later, a faecal sample was collected from the rectum of each trial animal and kept in a cooler box with ice packs, until processed and examined individually at the laboratory on the same day.

Faecal egg counts

Faecal egg counts were performed using a modified McMaster method, with a detection level of 100 eggs per gram of

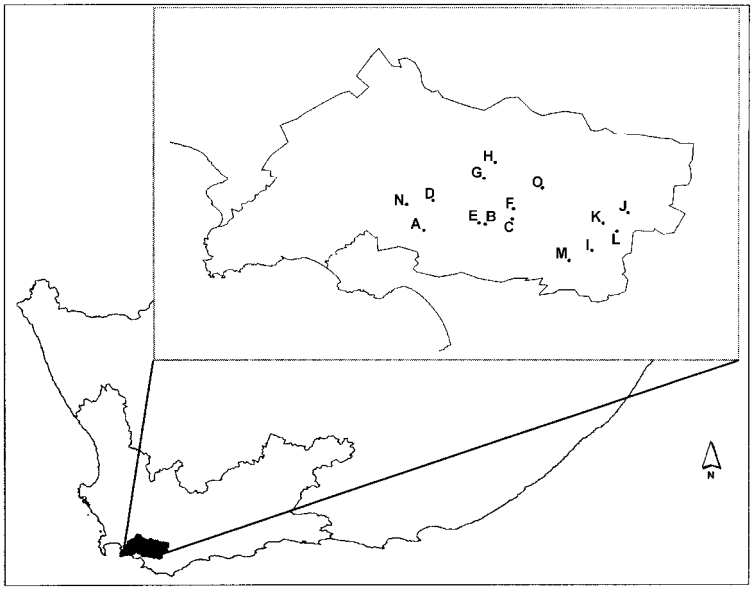

Fig. 1: **Map of South Africa showing the location of the Caledon area and the farms surveyed.**

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faeces[9]. A geometric mean egg count of at least 100 eggs per gram of faeces was set as the minimum for continuing with the test.

Analysis of results

The percentage efficacy was estimated by comparing the pre- and post-treatment egg counts using the following formula[12]:

$$FECR\% = 1 - \left(\frac{T_1}{T_2} \times \frac{C_1}{C_2}\right) \times 100 \quad (1)$$

where FECR = faecal egg count reduction, *T* = treatment, *C* = control, 1 = arithmetic mean of egg counts pre-treatment, 2 = arithmetic mean of egg counts post-treatment

Interpretation of results

Each result was classified into 1 of 3 categories according to the percentage reduction of egg counts.

The categories were 'No resistance' where the reduction was ≥95 %[5,7], 'Suspected resistance' (90–94 %)[1,2] and 'Resistance' (<90 %).

RESULTS

The percentage reduction in faecal egg counts on each farm is represented in Table 1.

Resistance (<90 % FECR) was recorded on 73 % (11 farms) of the farms surveyed, with 46 % of these involving resistance to 1 drench, 36 % to 2 drenches and 18 % to 3 drenches. Of the total number of farms, 60 % had resistance to benzimidazole (mean = 45.6 %, range = 6.3–86.9 %), 40 % to levamisole (mean = 53.9 %, range = 7.9–87.0 %) and 27 % had resistance to ivermectin (mean = 80.2 %, range = 76.2–87.0 %). With the exception of 1 property where resistance was suspected (Farm J, Table 1: 94.2 % efficacy) moxidectin was > 95 % effective (mean = 99 %, range = 94.2–100 %) (Table 2).

Table 1: **Percentage reduction in faecal egg counts on each farm for the different anthelmintics tested and the mean pre-treatment faecal egg count for the control group.**

Farm	Mean EPG Control group Pre-treatment	FECR % Anthelmintic			
		ABZ	IVM	MOX	LEV
A	966.7	93.8	100	99.4	98.9
B	162.5	67.0	97.0	95.1	95.1
C	662.5	95.6	99.3	96.7	97.2
D	590.0	95.6	96.4	99.4	87.0
E	250.0	48.5	81.0	100	93.1
F	520.0	93.6	87.0	100	97.7
G	916.7	62.9	76.2	100	7.9
H	1314.3	90.1	91.1	100	92.4
I	188.8	59.7	100	100	93.2
J	450.0	24.2	100	94.2	97.7
K	180.0	6.3	100	100	60.6
L	288.9	86.9	100	100	36.8
M	177.8	96.5	99.0	100	94.9
N	170.0	17.3	100	100	71.2
O	333.3	37.3	76.7	100	60.3

ABZ = Albendazole [Prodose Green, Logos Agvet (Virbac), 3.8 mg/kg].
IVM = Ivermectin [Ivomec, Logos Agvet (Virbac), 0.2 mg/kg].
MOX = Moxidectin [Maxicur, Hoechst Roussel Vet (Intervet), 0.2 mg/kg].
LEV = Levamisole [Tramisol, Hoechst Roussel Vet (Intervet) 7.5 mg/kg].

DISCUSSION

Although a shortcoming of this survey was that that the nematode genera represented in the faecal egg counts were not differentiated by means of larval cultures[6], the aim of the study was to determine whether anthelmintic resistance was present in the study area. From previous work, however, it is known that *Teladorsagia circumcincta* and, to a lesser extent, *Trichostrongylus colubriformis* predominate[8]. Because the survey was conducted on 21 % of 70 farms to which letters were despatched, it is possible that only farmers who were concerned about resistance requested an investigation. Nevertheless, it is apparent that resistance does occur in the Caledon area, and may be serious, considering that on 2 of the farms only moxidectin was effective. It be should considered, however, that the FECR test is known to be relatively insensitive to detecting low levels of resistance and that it has been shown that while still effective at the therapeutic dosage, moxidectin is also marginally affected in cases of resistance to ivermectin[10]. Moxidectin can thus not be relied upon where ivermectin resistance occurs.

In this study, worm populations were classified as resistant only at efficacy levels <90 %[1,4,5]. However, it has been suggested that the current criterion for resistance might be too low, as the reduction in faecal egg counts tends to be higher than the reduction in worm burdens. It might therefore be better to raise the threshold below which resistance is accepted to 95 %[3,4]. If this is accepted, the percentage of farms where resistance to the benzimidazole groups exists would increase from 60 % to 80 %, for ivermectin from 26 % to 33 % and for levamisole from 40 % to 67 %. Furthermore, it would mean that resistance to moxidectin exists on one of the farms (Table 2). An indirect effect of multiple resistance can be that the remaining effective remedies will be used more frequently than at present, thus increas-

Table 2: **Percentage of farms with resistance to a specific anthelmintic as well as the mean reduction for all farms for that anthelmintic.**

Anthelmintic	Percentage of farms			Mean (range) of efficacy for all farms
	No resistance (95–100 %)*	Suspected resistance (90–94 %)	Resistance (<90 %)	
ABZ	20	20	60	65.0 (6.3–96.5)
IVM	67	7	26	93.6 (76.2–100)
MOX	93	7	0	99 (94.2–100)
LEV	33	27	40	78.9 (7.9–98.9)

*FECR percentage.

ing the likelihood that resistance to them will develop.

In registration trials in South Africa, levamisole was found to be ineffective against the 4th-stage parasitic larvae (L4) of *Teladorsagia circumcincta,* and only 60 % effective against adults of this nematode. If previous studies that showed that *Teladorsagia* predominate in this area[8] are taken into account, the results for the levamisole drench might differ from those obtained in this study. Based on the 60 % efficacy claim, the percentage of farms with resistance may change from 40 % (< 90 % FECR) to only 13 % (< 60 % FECR). Since larval cultures were not performed in this study and it is known that *Teladorsagia* may predominate in this area, the results for levamisole in the present study cannot be evaluated according to the criteria used for the other 3 drugs tested.

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