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SMALL RUMINANTS ON PRIVATE FARMS IN PENINSULAR MALAYSIA: NEMATODE RESISTANCE TO ANTHELMINTICS

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SUMMARY

This paper reports the occurrence of nematode anthelmintic resistance on the 18 small ruminants private farms located in Peninsular Malaysia. Nematode faecal egg count reduction tests (FECRT) was conducted to evaluate the status of resistance of nematode populations to four types of anthelmintics, that is, oxfendazole, moxidectin, levamisole and closantel. It was found that nematode population on all farms showed resistance to closantel, nematode population on 13 farms showed resistance to oxfendazole, nematode populations on 8 farms showed resistance to levamisole and nematode population on 4 farms showed resistance to moxidectin. Third stage infective larvae collected from pre-treatment faecal cultures from 16 farms showed *Haemonchus contortus* to be the most prevalent species (overall prevalence of 56%), followed by *Trichostrongylus* spp. (30%), *Bunostomum* spp. (7%), *Oesophagostomum* spp. (4%) and *Cooperia* spp. (3%).

Keywords: Small ruminants, private farms, nematode resistance, anthelmintics

INTRODUCTION

Anthelmintic resistance in sheep and goats in Malaysia was first reported in the early 1990s, with demonstrations of resistance to the benzimidazoles (Rahman, 1993; Rahman, 1994a;b; Pandey and Sivaraj, 1994, Dorny *et al.*, 1994), levamisole (Dorny *et al.*, 1994) and the first case of multiple anthelmintic resistance reported by Sivaraj and co-workers in 1994 (Sivaraj *et al.*, 1994). Later in 1999, a nationwide anthelmintic resistance survey was conducted, involving 48 farms, and the study reported resistance to benzimidazole, levamisole, closantel, ivermectin and a combination of levamisole and closantel (Chandrawathani *et al.*, 1999). As this problem is escalating, the objective of this study is to evaluate the status of anthelmintic resistance against gastrointestinal nematodes of sheep and goats in Peninsular Malaysia to all four of the commercially available anthelmintic groups in the country, that is, Benzimidazole, Macrocyclic Lactones, Imidazothiazole and Salicylanilides.

MATERIALS AND METHODS

A total of 12 goat farms and 6 sheep farms were selected to conduct the Faecal Egg Count Reduction Test (FECRT). Nine goat farms were located in Perak, while the others were in Kelantan (1), Negeri Sembilan (1), and Terengganu (1). Two sheep farms were located in Kelantan while others were in Pahang (1), Melaka (1) and Johor (1). All the farms were privately owned enterprises and the number of animals ranged from 45 to 1000 heads in the goat farms and ranged from 70 to 260 heads in the sheep farms. In most of the farms, the sheep and goats were crossbreds, as the farmers had kept various breeds together in their farm since they had started farming. More than 80% of the farms practised semi-intensive management, whereby animals grazed on pastures, under oil palm plantations, around the shed, forest fringes along the river bank during the day and housed on raised floor sheds during the night. Animals in the shed were supplied with water *ad libitum*, salt or mineral licks and some farmers also provided commercial pelleted feed such as Palm Kernel Cake and soy pellets. Fifty percent of the farmers dewormed the animals twice per year with available anthelmintics from the market.

The nematode Faecal Egg Count Reduction Test (FECRT) was conducted based on the methods outlined by Coles *et al.* (1992) to evaluate the status of resistance of nematodes to four types of anthelmintics; oxfendazole, moxidectin, levamisole and closantel. In each of the selected farms, animals were divided into 5 equal groups of 6-15 animals and treated orally with: oxfendazole (5.0mg/kg; Oxfenthic 10, Bovet Pharmaceutical), moxidectin (0.2mg/kg; Cydectin, Fort Dodge), levamisole (7.5mg/kg; Levaminthic 2.5%, Bovet Pharmaceutical) and subcutaneously with closantel (2.5mg/kg; Flukiver 5, Janssen Animal Health) according to individual body weight. The control group did not receive any treatment.

In each farm, pre-treatment rectal faecal samples were collected from each animal. The animals in each treatment group were identified and treated. The animals in the control group were identified and no treatment was given. Faecal samples collected were subjected to McMaster method for faecal egg count and faecal culture method to identify the species of nematodes present in each farm. The faecal culture method was done by pooling all the samples in each farm. Rectal faecal samples were collected again on 10 to 14 days post treatment, for McMaster methods (Anon., 1986).

RESULTS

Analysis of data to evaluate the status of resistance was conducted based on the protocol outlined by Coles *et al.*(1992). Resistance to a particular anthelmintic was considered to be present if the reduction in faecal egg count was less than 95% and also the 95% lower confidence limit was less than 90%. If only one of the two criteria was met, the status was considered as suspected resistance. If the reduction in faecal egg count was more than 95% and the lower confidence limit was more than 90%, the status was considered as susceptible (Coles *et al.*, 1992).

The resistance status of nematode populations on goat farms is shown in Table 1. Nematode populations in twelve goat farms (100%) were found to be resistant to closantel, nematode populations in 9 goat farms (75%) were found to be resistant to oxfendazole, nematode populations in 8 goat farms (67%) were found to be resistant to levamisole and nematode populations in 3 goat farms (25%) were found to be resistant to moxidectin. Nematode populations with suspected resistance to moxidectin was found in 2 farms, oxfendazole in 1 farm and levamisole in 1 farm.. Nematode populations with susceptibility to moxidectin was found in 7 farms, levamisole in 3 farms and oxfendazole in 2 farms.

Based on Table 2, it was found that nematode populations in all of the sheep farms (100%) were resistant to closantel, nematode populations in 4 sheep farms (67%) resistant to oxfendazole, nematode populations in 2 sheep farms (33%) resistant to levamisole and nematode populations in 1 sheep farm (17%) resistant to moxidectin. Nematode populations with suspected resistance to levamisole were only found in 2 farms (33%). Nematode populations in five farms (83%) were found susceptible to moxidectin, nematode populations in 4 farms were found susceptible to levamisole (67%) and nematode populations in 2 farms (33%) were found susceptible to oxfendazole.

Third stage infective larvae recovered from faecal cultures of 16 farms indicated that *Haemonchus contortus* is the predominant species (mean estimate of 56% for all faecal cultures) followed by *Trichostrongylus* spp. (30%), *Bunostomum* spp. (7%), *Oesophagostomum* spp. (4%) and *Cooperia* spp. (3%).

Table 1: Anthelmintic resistance status on goat farms (n=12)

Anthelmintic	No. of resistant farms (%)			No. of suspected resistant farms (%)	No. of susceptible farms (%)
	FECRT <50%	FECRT 50-90%	FECRT 90-95%* LCL <90%	FECRT >95% + *LCL <90%	FECRT >95% + *LCL >90%
Oxfendazole	0	5 (42)	4 (33)	1 (8)	2 (17)
Moxidectin	0	1 (8)	2 (17)	2 (17)	7 (58)
Levamisole	0	6 (50)	2 (17)	1 (8)	3 (25)
Closantel	2 (17)	10 (83)	0	0	0

Table 2: Anthelmintic resistance status on sheep farms (n=6)

Anthelmintic	No. of resistant farms (%)			No. of suspected resistant farms (%)	No. of susceptible farms (%)
	FECRT <50%	FECRT 50-90%	FECRT 90-95%* LCL <90%	FECRT >95% + *LCL <90%	FECRT >95% + *LCL >90%
Oxfendazole	0 (0)	4 (67)	0	0	2 (33)
Moxidectin	0	0	1 (17)	0	5 (83)
Levamisole	0	0	0	2 (33)	4 (67)
Closantel	1 (17)	5 (83)	0	0	0

DISCUSSION

In Malaysia, anthelmintic resistance of sheep nematodes to benzimidazoles was first reported in the early 1990s (Rahman, 1993; Rahman, 1994a; b; Pandey and Sivaraj, 1994). Later, surveys conducted around the same time reported benzimidazole resistance on 33 goat farms (Dorny *et. al.*, 1994). Despite resistance reported in these studies, the benzimidazole class of anthelmintics was still used excessively by farmers to control nematodes in sheep, goats and cattle. Thus, the selection of oxfendazole in the farms has led to the development of benzimidazole resistance in nematodes, as the status of susceptibility to oxfendazole was found only in 4 of the farms tested.

Initial studies in Malaysia showed that moxidectin, a member of macrocyclic lactone anthelmintics, was 100% efficacious against sheep nematode infections for up to 6 weeks (Chandrawathani *et al.*, 1998). It was found that 12 farms still had susceptible nematode populations to macrocyclic lactones. The percentage of susceptible farms was 67% in this study, the highest percentage compared to oxfendazole, levamisole and closantel.

In the first studies on anthelmintic resistance in Malaysia, levamisole resistance was not reported on sheep and goat farms (Rahman, 1994a; Pandey and Sivaraj, 1994). However around the same time, from 5 goat farms tested for anthelmintic resistance, 2 showed resistance in nematode populations to levamisole (Dorny *et al.*, 1994). Later in 1999, 23% of sheep farms and 57% of goat farms were found resistant to levamisole (Chandrawathani *et al.*, 1999). Levamisole resistance in nematodes of goats developed rapidly during this 6-year period. This result was confirmed in this investigation where 67% of the goat farms showed resistance to this drug. No resistance was detected for levamisole in sheep farms involved in this study.

Ten years ago, closantel was found to be highly efficacious against *H. contortus* (Chandrawathani *et al.*, 1996). However, all farms tested in this investigation showed nematode population resistance to this drug. This is possibly due to the fact that in 1980s the Malaysian Department of Veterinary Services encouraged the use of closantel to combat helminthosis since it was found to be efficacious against nematodes and liver flukes (Chandrawathani *et al.*, 1996). It is highly probable that the frequent use of closantel on government farms until early 2000s has led to the development of closantel resistant nematode populations and this problem has spread to other farms when the animals from these government farms were distributed to commercial farmers during the 'pawah' programme (In this programme, new farmers can apply to buy animals from the government farms to start their farms). This is the first report of total closantel resistance in 18 small ruminant farms in Peninsular Malaysia.

CONCLUSION

Overall, the private goat and sheep farms showed that closantel cannot be used effectively for worm control whereas oxfendazole, moxidectin and levamisole can still be used in some of the farms. There is an urgent need to evaluate other sustainable methods for worm control in Malaysian smallholder farms.

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