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INTEGRATED CONTROL OF NEMATODE PARASITES OF SHEEP IN THE HUMID TROPICS OF SOUTHEAST ASIA

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INTRODUCTION

Two major constraints for increased sheep production in humid tropics of South-East Asia are small size of local breeds and infection with gastro-intestinal nematodes. Although several species of nematodes are encountered in sheep, *Haemonchus contortus* and *Trichostrongylus* spp. are the most prevalent ones (Dorny et al 1995) causing production losses, disease and mortality (Handayani and Gatenby 1988). Due to favourable climatic conditions, the transmission of parasites occurs throughout the year (Ikeme et al.1987; Dorny et al 1994). Control is based mainly on frequent suppressive anthelmintic treatments although alternative strategies including pasture rotation and breeding for resistance to worms have also received attention (Carmichael 1993; Pandey et al 1994).

As in the other parts of the world, in South-East Asia too, frequent use of anthelmintics has led to emergence of worm populations resistant to anthelmintics. Recently benzimidazole, levamisole and ivermectin resistance in sheep has been reported from peninsular Malaysia (Pandey and Sivaraj 1994a; Sivaraj and Pandey 1994; Sivaraj et al 1994). In Fiji, benzimidazole resistance is common in small ruminants (Walkden-Brown and Banks 1986). In goats too, there are reports of anthelmintic resistance from Malaysia and Thailand (Dorny et al 1993, 1994; Kochapakdee et al 1995). In all these reports resistance involved mainly *H.contortus* but resistance is shown against *T.colubriformis* as well (Sivaraj et al 1994).

In South-East Asia there is a great interest and potential for development of sheep husbandry. In 1993 the governments of Indonesia, Malaysia and Thailand formed a Northern Growth Triangle. One of the projects envisaged was the integrated development of sheep agribusiness system under which

Indonesian provinces of North Sumatra and Aceh will develop sheep production. In several countries of the region, there is a great potential for sheep development under rubber and oilpalm plantations.

The present paper describes some of the work done, mainly in Sumatra, Indonesia for integrated control of gastro-intestinal nematodes using strategic anthelmintic treatment, pasture rotation and breeding sheep for increased resistance to worms.

EPIDEMIOLOGICAL STUDIES

As pointed out by Pandey (1995), knowledge of host-parasite relationship is essential for understanding the epidemiology, which is a prerequisite for devising appropriate control measures.

In humid tropics with year round rainfall, as is the case in Sumatra and most of Malaysia, pre-parasitic stages of gastro-intestinal strongyles are able to develop throughout the year and therefore infective larvae are available on pastures at all times of the year (Carmichael,1993). There is no well demarcated seasonal pattern of infection except some minor variations (Romjali et al 1997b).

In a series of studies on the peri-parturient rise (PPR) in faecal strongyle egg counts of different genotypes of sheep in Sumatra, a significant rise in egg counts was found during the post-parturient period. *H.contortus* was the predominant species contributing to the PPR. Litter size and genotype of sheep had a significant effect on post-parturient egg counts (Romjali et al 1997a; Batubara et al 1997). Among the four genotypes studied, the egg counts were highest in Sumatra breed and lowest in the Barbados Blackbelly x Sumatra cross ($p<0.05$). The importance of PPR in ewes in the humid tropics is not well established. But, certainly it contributes to the increased contamination of pastures and consequently to a higher risk of infection of young lambs.

Studies on survival of infective larvae of *H.contortus* and infectivity of pastures measured by using tracer lambs in Sumatra showed that there is a progressive decrease in the number of infective larvae on pasture and by 12 weeks, only a very small percentage of larvae are available to grazing animals (Carmichael 1993; Batubara et al 1995).

The regular faecal examination of sheep grazing under rubber plantations and use of tracer lambs have shown that animals acquire infection soon after anthelmintic treatment, even on pastures spelled for 12 weeks, and peak

counts of upto 2000 egg/g of faeces reach within 3 months (Batubara et al 1995; Romjali et al 1997b).

The practical implication of these epidemiological findings are that if animals are kept permanently on the same pasture, high levels of infection would be built up in a short time necessitating treatment at frequent intervals to avoid losses in productivity and mortality. This is further compounded by peri-parturient increase in egg counts and higher susceptibility of some breeds/genotypes.

CONTROL STRATEGIES

Three control strategies, namely anthelmintic treatment, pasture management and exploitation of genetic resistance of sheep to nematodes, have been used simultaneously in sheep grazing under rubber plantations at an institutional farm in North Sumatra.

Anthelmintic treatment

Lambs are grazed with their dams and they are first treated at weaning at the age of three months. All grazing animals are treated once every three months. The anthelmintics (benzimidazole, levamisole, ivermectin), have been rotated at yearly basis. The efficacy of all three groups of anthelmintics was evaluated at the institutional farm as well as on several small holder farms. At all the tested sites, the efficacy was 95-100 per cent (Dorny et al 1995). These results are quite different from those of peninsular Malaysia with similar climate, where anthelmintic resistance has been recorded against all the three chemical groups (Pandey and Sivaraj 1994b; Sivaraj et al 1994). In fact, in Malaysia on some properties, resistance has developed against all the three chemical groups simultaneously.

Pasture management

Based on the studies on survival of infective larvae on pasture, the pasture rotation is practiced every 3 month. Animals are dewormed and then moved to pastures which have been spelled for 3 months. As some infective larvae are still available on these pastures, a gradual build up of infection occurs (Batubara et al 1995). To avoid production losses due to high infection, animals have been treated every three months. This "treat and move" strategy has proved effective in controlling the gastro-intestinal nematodes. If enough grazing areas are available, it is recommended that pastures be spelled for periods longer than 12 weeks, which would further minimise the frequency of use of anthelmintics.

Genetic resistance

The local Sumatra sheep is a wool breed, which is prolific but small in size. Therefore, two hair sheep of higher body size, namely Barbados Blackbelly and St.Croix, were used for crossbreeding. The crossbreds, 50% Sumatra x 50% Barbados Blackbelly or 50% St.Croix, were produced and evaluated for parasitological and production parameters under natural and experimental infection conditions. Analysis of egg counts, body weight and packed cell volume (PCV) showed a positive correlation between PCV and body weight and a negative correlation between egg count and body weight (Romjali et al 1997b). Crosses of Barbados Blackbelly and St.Croix had equal or lower worm burdens (Romjali et al 1997b) but significantly higher body weights and productivity than the local Sumatra breed (Table 1). Therefore, a synthetic hair sheep genotype with 50% Sumatra, 25% Barbados Blackbelly and 25% St.Croix blood, has been created to incorporate the high prolificity of Sumatra as well as higher resistance to gastro-intestinal nematodes and higher body weight of Barbados Blackbelly and St.Croix.

Table 1 : Weight of lambs at birth and weaning and dam productivity index (DPI)
(source : Gatenby et al, 1997).

Breed Type	Weight of lambs (kg)		DPI (kg)
	Birth	Weaning	
Sumatra	1.45 a	8.5 a	16.0 a
St.Croix x Sumatra	2.03 b	11.7 b	21.5 b
Barbados Blackbelly x Sumatra	2.10 b	12.1 b	24.2 b

a,b Means not having a common superscript within a column are significantly different ($P < 0.001$).

$$DPI = \frac{\text{Total weight of lambs weaned at Ist and 2nd lambing}}{\text{Age of ewe at 2nd lambing-200 days}}$$

Controlled experimental infections of different genotypes with *H.contortus* showed difference in worm burden between genotypes and also between individuals within each genotype (Romjali et al 1996; Batubara 1997; Personal observations V.S.Pandey). There is thus an opportunity for selection and breeding for increased resistance to worms. As heritability of

resistance to nematodes in sheep is about 0.3, similar to heritabilities of production traits for which selection has been rewarding (Barger 1989), there is a good scope of improving genetic resistance status of sheep by selection. The feasibility of this approach has been demonstrated in some other studies as well, mainly in Australia and New Zealand (see for review Gray et al 1995).

CONCLUSIONS

Gastro-intestinal nematodes are and would continue to be a major problem in sheep production in humid tropics. Current pratice of sole reliance on intensive chemotherapy is neither desirable nor sustainable, as it would lead to anthelmintic resistance and other problems related to environment and residues.
Therefore, an integrated approach incorporating pasture management, minimal anthelmintic medication and use of animals with higher resistance to nematodes is advisable.

The use of these three strategies has proved satisfactory in studies in North Sumatra. However, at small holder level, such strategies may pose some difficulties due to lack of enough grazing grounds, availability and/or cost of anthelmintics and shortage of improved breeds/genotypes with higher resistance to worms and higher body weight. Although breeding sheep for higher resistance is a slow process of long duration, its fruits are long lasting and would be cost-effective. It would also reduce/delay the risk of appearance of anthelmintic resistance which has become a serious problem in several countries.

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