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EPIDEMIOLOGY OF TRICHOSTRONGYLES OF SHEEP GRAZING UNDER OIL PALM

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EPIDEMIOLOGY OF TRICHOSTRONGYLES OF SHEEP GRAZING UNDER OIL PALM

BY

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June 1995

Chairman : Assoc. Prof. Dr. Rehana Abdullah Sani

Faculty : Veterinary Medicine and Animal Science

Endoparasitism is one of the major constraints to the sheep industry in Malaysia. In order to formulate control measures for endoparasitism an understanding of the epidemiology of the infrapopulation and suprapopulation is required. Therefore an epidemiological study of trichostrongyles in sheep was conducted.

The pattern of faecal egg output in lambs was observed for twelve months. Infection was first observed at six weeks of age, peaked at twelve weeks, then steadily decreased till it stabilised after eight months, thus indicating an acquired immunity trichostrongyles around eight months. Periparturient rise in egg counts was seen in ewes with a sharp increase in epg one month before and for two months after parturition. From the meteorological parameters monitored, it showed that rainfall and temperature influenced the egg output profile.

Pooled faecal culture of samples from lambs and ewes showed that *Haemonchus* sp. was the predominant species, followed by *Trichostrongylus* sp., while larval counts of Oesophagostomum sp. and *Cooperia* sp. did not exceed 5%. In the lambs and ewes that died total worm counts had more numerous *Haemonchus contortus* than *Trichostrongylus colubriformis*.

Two techniques for larval recovery from herbage were compared. The recovery rate by the Modified Parfitt's technique was 25% and by the Modified Baermann's technique was 33%. There was no consistent relationship between larval recovery and weight of fresh herbage collected during wet and dry periods.

The time of development of infective larvae (L3) was measured in the field in both wet and dry periods. In both periods L3 emerged from faecal samples on day four and was present on herbage on day six with the highest number of larvae being present on day seven. Monitoring of the survival of L3 found on herbage showed negligible numbers of L3 after week seven in the wet period and negligible numbers of L3 at week five in the dry period.

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia, sebagai memenuhi keperluan untuk mendapat Ijazah Master Sains.

EPIDEMIOLOGI CACING TRICHOSTRONGYLE PADA BEBIRI YANG MERAGUT DALAM LADANG KELAPA SAWIT

Oleh

SAM MOHAN a/l ARUPUTHAM

June 1995

Pengerusi : Prof. Madya Dr. Rehana Abdullah Sani

Fakulti : Kedoktoran Veterinar dan Sains Peternakan

Endoparasitisma adalah satu faktor utama yang mengancam industri ternakan berbiri di Malaysia. Bagi mengawal keadaan ini kita perlu memahami corak epidemiologi pada infrapopulasi dan suprapopulasi cacing 'trichostrongyle'.

Profil pengeluaran telur cacing pada anak bebiri dijalankan selama setahun. Infeksi permulaan diperolehi apabila anak bebiri berumur enam minggu. Pengeluaran telur kemudian meningkat ke tahap maksima pada umur duabelas minggu dan beransur berkurangan sehingga menjadi stabil pada umur lapan bulan. Ini menunjukkan bahawa anak bebiri memperolehi pelalian terhadap jangkitan cacing ketika berumur lapan bulan. Peningkatan pengeluaran telur cacing pada ibu bebiri didapati berlaku sebulan sebelum parturasi sehingga dua bulan selepas itu. Kajian cuaca menunjukkan bahawa jumlah taburan hujan dan suhu persekitaran mempengaruhi profil pengeluaran telur cacing.

Kultur tinja yang diperolehi dari anak dan ibu bebiri menunjukkan jumlah larva *Haemonchus* sp. adalah yang terbanyak sekali, diikuti oleh *Trichostrongylus* sp. manakala yang lain ialah *Oesophagostomum* sp. dan *Cooperia* sp. yang tidak melebihi 5%. Kiraan jumlah cacing dari anak dan ibu bebiri yang mati juga menunjukkan bahawa cacing *Haemonchus contortus* melebihi *Trichostrongylus colubriformis*.

Dua kaedah memperolehi larva daripada rumput dibandingkan. Didapati bahawa kaedah Parfitt dapat mengesan 25% berbanding kaedah Baermann yang dapat mengesan 33% daripada jumlah yang ditaburkan keatas sampel rumput yang diuji. Kajian statistik menunjukkan bahawa tidak terdapat perhubungan yang konsisten diantara jumlah larva yang diperolehi dengan berat sampel rumput pada kedua musim.

Tempoh pengembangan larva infektif (L3) dikaji pada musim lembap dan musim kering. Pada kedua musim ini L3 dikesan pada sampel tinja pada hari keempat dan pada sampel rumput pada hari keenam, didapati L3 terbanyak pada sampel rumput pada hari ketujuh. Jangkahayat L3 pada sampel rumput yang diambil setiap minggu menunjukkan bahawa pada musim kering L3 berkurangan selepas minggu kelima, manakala pada musim lembap jumlahnya berkurangan pada minggu ketujuh.

CHAPTER I

INTRODUCTION

Integrating small ruminants especially sheep with primary crops like rubber and oil palm is now widely practised in Malaysia (Ani Arope, 1992). This practise is feasible because it optimizes the use of land, promotes agricultural diversification and utilizes undesirable undergrowth in the interrows (Tan and Abraham, 1982).

Disease is among the major constraints to the development of the sheep industry in Malaysia. Endoparasitism due to gastro-intestinal nematodes is frequently reported as the second most common cause of mortality in sheep in both smallholder and large scale operations in the country (Sani and Rajamanickam, 1990). The humid tropical environment in Malaysia is very conducive for development and survival of trichostrongylid larvae on pasture throughout the year (Ikeme et al., 1987). Consequently, due to land limitations grazing animals (including the highly susceptible young) nearly always over graze on pasture containing large numbers of infective larvae.

In order to reduce this form of parasitism, a formulation of control measures which combine strategic use of chemicals with pasture management systems is

required. The epidemiology of the infrapopulation (stages inside the host) and suprapopulation (free-living stages) of trichostrongyles in sheep is needed in order to develop the control strategies.

Studies of sheep grazing in open pasture have recently been reported (personal communication by Cheah T. S.) and studies under rubber is being undertaken by Universiti Pertanian Malaysia in the Rubber Research Institute Malaysia but none have been carried out in sheep grazing under oil palm. Therefore this study was undertaken to obtain the necessary information.

The objectives of this study was to :

1. determine when lambs acquire immunity towards trichostrongyles,
2. obtain the period of periparturient rise in ewes based on patterns of faecal egg output,
3. assess the time intervals for the emergence of preinfective and infective stages, (ie.free-living first-stage [L1], second-stage [L2] and infective third-stage [L3]) and
4. assess the survival period of L3 under oil palm cover.

CHAPTER II

LITERATURE REVIEW

Sheep Industry in Malaysia

Sheep rearing in Malaysia before the last two decades was primarily a smallholding activity in rural areas and served to provide supplementary income and savings to the farmers (Chee and Ibrahim, 1994). Since the mid seventies, the Rubber Research Institute Malaysia (RRIM) and the Rubber Industry Smallholder Development Authority (RISDA) made some attempts to rear sheep among the smallholdings.

On the other hand, goat production thrived better compared to sheep rearing. The preference for goat meat brought better financial returns to farmers, hence there was little interest in sheep. In the mid eighties, owing to increased land limitations and the browsing habits of goats destroying agricultural crops, goat rearing in rural areas declined. With the decline in goat rearing, the Department of Veterinary Services, Malaysia embarked into sheep rearing to contribute to the future need of local mutton production (Chee and Ibrahim, 1994). At the moment Malaysia does not have the sheep farming tradition and the sheep production can hardly be considered an industry.

The interest to promote sheep farming integrated with the plantation sector started in the mid eighties, when the country was experiencing an economic recession. The plantation industry (rubber and oil palm) was also facing poor returns due to global recession. Around this time, there was also a growing environmental concern regarding the harmful effects from excessive use of weedicides. Therefore the Ministry of Agriculture, Malaysia and its agencies highlighted the potential use of sheep as a biological weeding agent, which renewed interest to promote sheep farming in the plantation sector. Since then regular and sizeable importation of breeding stocks brought about a significant increase in the sheep population in Malaysia (Table 1).

Table 1 : Sheep Population in Peninsular Malaysia [Chee and Ibrahim, 1994]

Year	Population (head)
1975	45,500
1980	59,300
1985	78,300
1990	120,000
1995	275,000*

* denotes estimate

Infrapopulation Studies

Disease and Helminthiasis in Sheep

One of the major constraints to small ruminant production is disease. The major disease problems in order of importance include pneumonic pasteurellosis, endoparasitism, mange, contagious echthyma, melioidosis and caseous lymphadenitis (CLA). In sheep, additional problems include "Blue-tongue" and contagious kerato-conjunctivitis ("pink-eye"). Endoparasitism is frequently reported as the second most common cause of mortality in sheep in both smallholder stocks as well as large-scale operations (Mohna, 1976; Sheikh-Omar and Chulan, 1980; Sani and Rajamanickam, 1990 and Amin-Babjee et al.,1990).

The most common diagnosis made on ovine carcasses in a study at Universiti Pertanian Malaysia was haemonchosis (Sheikh-Omar and Chulan, 1980). Rehana et al. (1986) reported in a six year study, that 90% of post-mortem cases were positive for *Haemonchus contortus*, followed by mixed infestation with *Trichostrongylus colubriformis* (59%), *Oesophagostomun columbianum* (25%) and *Moniezia expansa* (22%). In a similar study in goats (Rehana et al., 1985) the same four species also predominated. However, the list of helminths in their study differed from Shanta (1982) as in the absence of hookworms, *Bunostomum* sp. and *Gaigeria* sp, The species of *Cooperia* also differs; *C.cuticei* was isolated by her whilst *C.punctata* was isolated by Shanta.

These trichostrongyles have similar lifecycles and can occur in large numbers. The major effects of the blood sucking activity of *Haemonchus* sp. are anaemia and hypo-proteinemia. The *Trichostrongylus* sp. and *Oesophagostomum* sp. cause intestinal epithelial damage which causes protein leakage into the gut. Hence parasitic gastro-enteritis produces a negative nitrogen balance in the animal that is closely related to inappetence (Sani and Rajamanickam, 1990). The usual necropsy findings in parasitic gastro-enteritis include emaciated carcass, pale muscle and viscera, watery blood, oedema in the lungs, thoracic and peritoneal cavities and sub-cutaneous tissue particularly in the neck region and a generalized serous atrophy of fat depots (Rehana et al., 1986).

According to Rehana et al. (1986) young sheep had a higher worm count than old sheep, which is generally accepted that old sheep are immunologically more competent than lambs. Lambs below six months of age are unable to develop protective immunity against *H.contortus* (Karugah,1982)

Age alone is not the only factor that determines the degree of infestation, as other factors like previous exposure to the parasite, intake of L3 and the presence of adult worms that affects the immune response (Rehana et al., 1986). Diet also influences infections with *H.contortus*. Preston and Allonby (1978) showed that sheep and goats fed on a low protein diet developed severe clinical disease and failed to "self-cure" to the same degree, as animals fed on a high protein diet. This self-cure reaction results in the loss of a burden of worms.

Effects of Gastro-Intestinal Parasitism upon Productivity

Man obtains meat and other by-products like milk, wool, hide and draft from ruminants. These are assets provided by the ruminant population in many parts of the tropics (Fabiyi, 1986). Unfortunately in maximising this form of profitability, adverse reactions have occurred due to intensive management practices. One major productivity loss is the effect of gastro-intestinal tract nematodes (Holmes, 1986). Their effects are manifested in a variety of ways with body weight reduction being the most common feature.

Sykes and Coop (1976, 1977) and Abbott et al.. (1986) reported up to 60% decrease in live-weight gain in sheep infected with *T.colubriformis, O.circumcincta* and *H.contortus.* The heavier the infection the more drastic are the effects (Dargie, 1979).

According to Holmes (1986) subclinical levels of infection can have considerable economic effects and the effect of gastro-intestinal parasites may persist even after their elimination. Nansen (1986) stated that it is becoming more evident that most production effects in the form of weight loss, lowered milk production, poor wool and carcass quality are associated with subclinical infections.

Abbott et al. (1985) have shown that in moderate to heavy infections, the voluntary food intake of sheep may be lowered by 20% or more. The degree of

inappetence being dependent on the burden, duration of infection and on the level of protein intake.

An important factor in assessing the economic impact of gastro-intestinal parasitism is in the changes in the body composition. Holmes (1986) stated that the decrease in deposition of fat, protein and skeletal calcium and phosphate with increased body water are changes noted. Sykes and Coop (1976, 1977) have shown these changes in production of around 15 to 45% lower in infected lambs compared to uninfected ones.

Steel et al. (1982) have shown that gastro-intestinal parasites have adverse effects on wool production with wool growth and quality being reduced by up to 40% in some infections (Barger et al., 1973). Decreased milk production due to the same parasites have been reported by Leyva et al. (1982) and Thomas and Ali (1983). Holmes (1986) suggested that reproductive performance may also be affected.

Intepretation of Faecal Egg Counts (FEC)

Control programmes which have been based on egg monitoring have shown the relationship between egg counts and worm populations (Roberts and Swan, 1981). This relationship is affected by faecal output, consistency, egg distribution, diurnal fluctuation and species fecundity (Michel, 1968).

Studies in cattle by McKenna (1981) demonstrated a lack of correlation between egg counts and worm burden which were in contrast with those of sheep done by Poteet and Conway (1966) and Le Jambre et al. (1971). This was confirmed by Roberts and Swan (1981) who found a strong relationship between FEC and total worm counts of sheep. The observation by Roberts and Swan (1981) was claimed to be a useful predictor on the level of infection among sheep. A strong correlation between FEC and worm burdens reflects a weakness of the density dependent population regulation, in terms of fecundity (Whitlock et al., 1972; Le Jambre et al., 1971). This condition is commonly seen in sheep and cattle harbouring *Haemonchus* sp. infections (Barger,1986). However, Le Jambre et al. (1971) claimed that the relationship was further improved by considering the biomass (weight of worm burden) of *H. contortus* rather than their number which was in agreement with the findings of Coadwell and Ward (1982).

Pradhan and Johnstone (1972) reported that fecundity of *H.contortus* was reduced with increasing population size and not development of immunity. Michel (1968) however suggested an implication of the host resistance, at least where calves were concerned, since infected calves treated with corticosteroids tend to pass more eggs than those not treated. He added that this condition is not due to direct stimulation on the worms since the egg output of calves treated with corticosteroids and infected at different rates was the same, suggesting a rise in the limit of egg production as a result of immunosuppression.