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Lungworm of cattle in Malaysia

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Abstract. Bovine lungworm *Dictyocaulus viviparus* is highly endemic in temperate regions. However, the occurrence of the lungworm has not been reported in any South East Asian country. The main aim of the present study was to detect the presence of lungworm in cattle in peninsular Malaysia and to examine the morphology of the parasite. A cross-sectional study was carried out in which 602 animals from four large scale government cattle farms and one dairy smallholder farm were sampled. In addition, 283 lungs from 11 abattoirs around the country were examined. Faecal samples were examined using the Baermann technique while post-mortem examination was performed on the lungs. Approximately 5% of faecal samples and 1% of lungs were positive for lungworm. Based on the morphology of adult lungworm, eggs and first stage larvae, Malaysian bovine lungworms were *D. viviparus*.

INTRODUCTION

Dictyocaulus viviparus is a pathogenic parasitic nematode that can cause verminous bronchitis. It typically affects young cattle during their first grazing season in temperate areas (Soulsby, 1965). Disease varies in severity from sporadic coughing to acute cases with a rapidly fatal outcome, depending on the number of larvae ingested and the immunity of the animal (Noble & Noble, 1976). The occurrence of bovine lungworm infection has been described in some tropical areas (Thamsborg *et al*., 1998). However, the parasite has only been reported previously in Malaysia once. In the study done on abattoir cattle slaughtered at Shah Alam, Malaysia by Tham & Sheikh-Omar (1981), the lungs were 3.4%. However, cattle were imported from Australia.

The objective of this study was to detect the presence of bovine lungworm and to describe and compare the morphology of Malaysian bovine lungworm with *D. viviparus* from publications and from Sweden.

MATERIALS AND METHODS

Sampling of farm

Malaysia lies near the Equator between latitudes 1° and 7° North and longitudes 100° and 119° East. There is no distinct wet and dry seasons with abundant rainfall throughout the year (>2000 mm). Temperatures are fairly constant ranging from 24°C to 34°C (mean: 27°C) with high humidity (>80%). The total cattle population in Malaysia is 731,484 (http://agrolink.moa.my/jph/dvs/statistics/statidx.html). A repeated cross-sectional study was carried out in four large scale government cattle farms (designated Farms A, B, C and D) and one dairy smallholder farm (designated Farm E). The four government farms are breeding centres for

local beef cattle, imported beef cattle and dairy cattle. The farms were selected for the study because they represent 50% of the national establishments for breeding and distribution of cattle. Sampling was conducted every two months in Farms A, B, C and D for a period of eight months and only once in Farm E. In total, Farms A and C were sampled four times while Farms B and D three times. At each time, about 3% of animals on the farm were sampled using the systematic sampling technique. Every third animal that walked through the restraining crate was sampled. If the particular animal had been sampled previously, it was not sampled again. Thus animals were sampled only once.

Sample collection

About 30 g of faecal sample was collected from each animal. A total of 602 faecal samples were collected during the study period and examined for first stage larvae (L1) of lungworm using the Baermann method. A Baermann stand was constructed on a table that could handle up to 30 samples in each baermannisation. Identification of the lungworm L1 was based firstly on its movement or motility and its morphology.

Detection of lungworm from abattoir samples

There are 25 abattoirs in peninsular Malaysia and 11 of these were visited from June 2004 to November 2006. The lungs of all slaughtered cattle and buffaloes were examined. The lungs were removed from the main body and placed flat on an examination table. The trachea, bronchi and bronchioles were cut open and examined carefully for lungworms. Any lungworm found were picked up using forceps and placed in 70% alcohol solution. Cattle that were slaughtered at the Universiti Putra Malaysia (UPM) mosque during religious festivals in 2005 and 2006 were also examined in the same manner. A total of 260 cattle and 23 buffalo lungs were examined during the period of study. The cattle originated mainly from Australia and some were from peninsular Malaysia.

Descriptive morphology and morphometry of lungworm

The examination for worm descriptive morphology and morphometry was done on the lungworm collected from slaughtered cattle. The worms were measured for length and width on the same day of collection. After examining the descriptive morphology and morphometry of the egg, L1 and adult lungworms, comparisons were made between the adult lungworms and the *D. viviparus* supplied by Dr. J. Hoglund from Sweden and to those described by Skrjabin & Schulz (1934), Soulsby (1965), Marquardt *et al*. (2000) and Bhatia *et al*. (2004). A comparison of eggs and L1 was also performed.

Data analysis

The prevalence of bovine lungworm infection was determined based on parasitological diagnosis and calculated by dividing the number of positive cases to the total number of cattle sampled. The relationships between the prevalence of lungworm infection with age, gender and grazing practice were examined by testing its significance using the Pearson Chi-Square test. Independent sample 't' test was used to test the difference in the measurement of adult worm, L1 and egg between Malaysian bovine lungworm and *D. viviparus* from publications and Sweden. The level of significance was tested at = 0.05. Statistical analysis was performed using SPSS ver. 13 (SPSS Inc. Chicago, Illinois).

RESULTS

Farm management and detection of lungworm infection

Animals on Farm E grazed on set stocked pasture throughout the year. Farms A, B, C and D mowed service cut and rested the pasture and practised rotational grazing. Farm A only allowed dry cows and bulls to graze. Generally animals grazed in each pasture for 2-5 days and the pasture was rested for 20-25 days. The prevalence of lungworm infection among the farms,

breed, age groups, gender and grazing practices are shown in Table 1. Four of five farms were positive for lungworm, but no patent infections were found on farm A. The prevalence (%) of parasitologically positive cases in the five farms ranges between 0 to 8.7%. The overall prevalence was 4.7%. The highest prevalence of lungworm infection was observed in d"6 month-old group (7.6%). Prevalence was higher in males (8.2%) than females (2.8%) and no significant difference ($p>0.05$) was observed between the two grazing practices.

Prevalence of lungworm infection in abattoirs

Lungworm was found in the lungs of three indigenous breed cattle (Kedah-Kelantan) (1.1%) while the other 257 cattle lungs and 23 buffaloe lungs were negative.

Morphological evaluation of Malaysian bovine lungworm

The morphological characteristics of Malaysian bovine adult lungworm, egg and L1 was consistent with that of *D. viviparus*. However, the slight cuticular inflation in the anterior portion of the adult worm was unique and not observed in *D. viviparus* from publications (Skrjabin & Schulz, 1934; Soulsby, 1965; Marquardt *et al.*, 2000; Bhatia *et al.*, 2004) and Sweden (specimens provided by Dr J. Hoglund). Additionally, the mean measurements of the Malaysian lungworms were 2.13 cm ± 0.12 (male length) and 0.38 cm ± 0.07 (male width); 2.89 cm ± 0.15 (female length) and 0.39 cm ± 0.02 (female width). These measurements were significantly different from those measurements described in publications (Skrjabin & Schulz, 1934; Soulsby, 1965; Marquardt *et al.*, 2000;

Table 1. Prevalence (%) of bovine lungworm positive cases different farms, breeds, age groups, gender and grazing practices

Factors	Bovine lungworm infection				*P*	χ^2
	Positive cases		Negative cases			
	No.	%	No.	%		
Farm						
A	0.0	0.0	164	0.0		
B	1	1.8	54	98.2		
C	15	7.6	182	92.4	NC	NC
D	8	5.7	132	94.3		
E	4	8.7	42	91.3		
Total	28	4.7	574	95.3		
Breed						
Friesian Sahiwal	4	1.9	206	98.09		
Nelore	16	6.4	236	93.7	NC	NC
KK	8	5.7	132	94.3		
Age						
≤6 months	16	7.6	194	92.4	0.034	6.773
>6 - 12 months	1	6.2	62	93.8		
>12 months	11	3.3	318	96.7		
Gender						
Male	17	8.2	191	91.8	0.003	8.890
Female	11	2.8	383	97.2		
Grazing practice						
Grazing	27	5.1	498	94.9	0.135	2.238
Non-grazing	1	1.3	76	98.7		

NC – No comparison of these factors

Bhatia *et al.*, 2004) and Swedish worms ($p<0.05$) except for the male width.

DISCUSSION

Prevalence of lungworm infection in this study was low compared to that in the temperate European countries. According to Murphy *et al.* (2006), the overall prevalence of patent lungworm infections in culled cows in Ireland was 14% based on faecal examination. It was consistent with recent anecdotal reports of increases in the number of outbreaks of parasitic bronchitis in adult cattle in Ireland and published reports from the United Kingdom (David, 1997). Indeed, lungworm infection is endemic in those countries. In a tropical country such as Brazil, 7.1% morbidity and 13.3% mortality due to lungworm infections was recorded (Silva *et al.*, 2005). In another tropical country like Tanzania, an overall prevalence of 8% to 28% diagnosed by faecal examination in dairy cattle farms was observed in the tropical highlands (Thamsborg *et al.*, 1998). However in Tanzania, the occurrence of lungworm infections was mainly due to imported dairy breeds and thus infection could have been introduced by *D. viviparus*-carrier animals (Thamsborg *et al.*, 1998). In Malaysia, Nelore cattle were imported into the country in 1991 from Brazil where *D. viviparus* infection has been reported (Silva *et al.*, 2005). Outbreaks of lungworm disease in the Nelore beef cattle breeding centre in Malaysia has been reported by Lat-Lat *et al.* (2007).

Allowing only dry cows and bulls to graze in Farm A could have decreased the load of infective lungworm larvae on pasture and additionally reduced the chance of adult animals passing the infection to non-grazing young calves.

The higher prevalence of lungworm infection in male cattle in this study was not described in any other study. In addition, gender predisposition is not known to occur in lungworm infection. However bulls and male sheep showed greater susceptibility to nematode parasitism than the females, attributable to testicular hormones (Barger, 1993). In this study, young cattle were most commonly affected by lungworm. Adult cattle might be infected at a lower rate due to the development of immunity (Soulsby, 1965).

The prevalence of lungworm in abattoir animals (1.1%) in this study was lower than the prevalence of 3.8% reported by Tham & Sheikh-Omar (1981). However finding of worms in three cattle of an indigenous breed (Kedah-Kelantan) is certainly noteworthy and it reveals that this tropical breed can be infected. Unfortunately the source of the abattoir animals in this study could not be traced.

The finding of Malaysian bovine lungworm being smaller than those described in publications and Swedish worms may be due to geographical variation or host resistance. Further analyses using molecular identification and characterisation technique will be needed for confirmation of the worm species.

The findings in this study have provided essential information about lungworm infection in cattle and buffaloes in peninsular Malaysia.

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