

Epidemiology and Pathogenicity of Bovine Theileriosis in Malaysia

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Abstract

A survey was undertaken to elucidate the epidemiology and pathogenicity of theileriosis in Malaysia. Blood samples of 322 cattle were collected and examined at 20 locations which covered seven states in Peninsular Malaysia. All the blood smears from cattle had *Theileria* parasites and piroplasm were associated with an intraerythrocytic bar and veil structure. The parasitaemia varied from less than 0.1% to 2.0%. Twenty-three cattle were considered anaemic based on their haematological parameters, particularly the values of packed cell volume which showed less than 20%. One calf, naturally infected by *Theileria* parasites, was splenectomized. The peak parasitaemia, or 17.9%, was observed at the 14th day after the splenectomy and there was a marked reduction in packed cell volume. On the 22nd day, the calf developed a transient infection of *Eperythrozoon wenyoni*. Tick collections were carried out from some grazing cattle on several occasions. Most of the ticks collected were *Boophilus microplus*, but two nymphs, four adult males and two adult females were of the *Haemaphysalis bispinosa* that might be a vector of *Theileria* in Malaysia.

Discipline: Animal health

Additional key words: *Haemaphysalis bispinosa*, splenectomy, taxonomy, *Theileria*

Introduction

Theileriosis is a complex of tick-transmitted diseases caused by protozoan parasites of the genus *Theileria*. The parasites infect wild and domestic animals, particularly cattle, and in many parts of the world they are a major constraint to the development and improvement of the livestock industry.

Bovine theileriosis in Malaysia has been known to exist since it was reported by Legg in 1958¹⁾. There is, however, little information on the study of bovine theileriosis. This study was undertaken to elucidate the epidemiology and pathogenicity of theileriosis in Malaysia.

Materials and methods

A survey was conducted during the period September to November 1988. EDTA blood samples from the cattle were collected at twenty locations which covered seven states in Peninsular Malaysia (Fig. 1). Blood smears were fixed in methanol, stained with Giemsa and examined regarding their theilerial intraerythrocytic forms, or piroplasms. The level of parasitaemia was expressed in percentages of parasitised erythrocytes in 1,000 erythrocytes.

The haematological parameters such as total erythrocyte and leucocyte counts, packed cell volume and haemoglobin contents were also examined.

A male of Local Indian Dairy Cross of one and



Fig. 1. Distribution of the twenty locations in Malaysia, where the blood samples were collected from the cattle

half year old, naturally infected with *Theileria* parasites, was purchased from the Pusat Latihan Ternakan at Sungai Siput, Perak. The calf was splenectomized and housed in moated pens. After the splenectomy, a blood sample was collected into EDTA tube for haematological examinations three times a week for the first week, then at daily intervals for 2 weeks and thereafter three times a week for 2 weeks.

Ticks were collected from some animals on several occasions. Unfed ticks were collected from pastures by dragging with a piece ($1 \times 0.7\text{m}^2$) of white cotton-flannel cloth.

Results

1) Haematological examinations

Blood samples of 322 cattle were collected and examined. The results of the examination of blood smears are shown in Table 1. All of the smears from the cattle had *Theileria* parasites and the piroplasm were round, oval ring forms or rod-like forms. Maltese cross forms were seen, indicating quaternary divisions occurring in the erythrocytes. The piro-

Table 1. Blood smears for *Theileria* parasites in 322 cattle in Peninsular Malaysia

Breed ^{a)}	Range of parasitaemia			Total no. examined
	<0.1	<1.0	<2.0	
KK	34	56	2	92
LID	39	30	1	70
TX	75	74	10	159
Others	1	0	0	1
Total	149	160	13	322

a): KK; Kedah-Kelantan, LID: Local Indian Dairy, TX; Temperate Crosses, Others; Unknown breed.

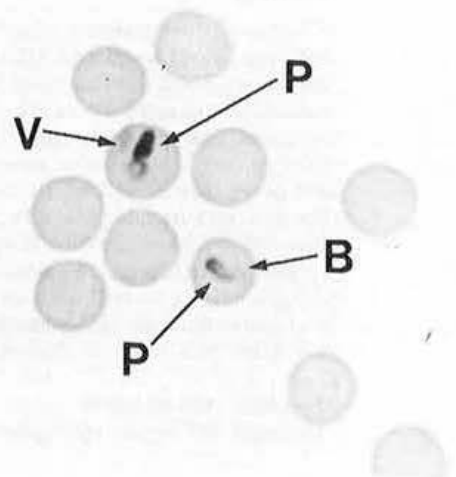


Plate 1. Calf blood smear showing intraerythrocytic piroplasm (P)

Both bar (B) and veil (V) structures are seen in the infected erythrocytes.

Giemsa staining. ($\times 1,250$)

plasms were associated with an intraerythrocytic bar structure. An intraerythrocytic veil structure was also seen in the parasitised red blood cells (Plate 1). The presence of the bar and the veil was variable in individual smears. The parasitaemia varied from less than 0.1% to 2.0%, however, the morbidity rate was 100%. In 149 samples of the cattle's blood smears examined, the parasitaemia was less than 0.1%. There was no significant difference in the parasitaemia between breeds at a probability level of 5% (Student's *t*-test). Based on the haematological parameters, particularly the values of packed cell

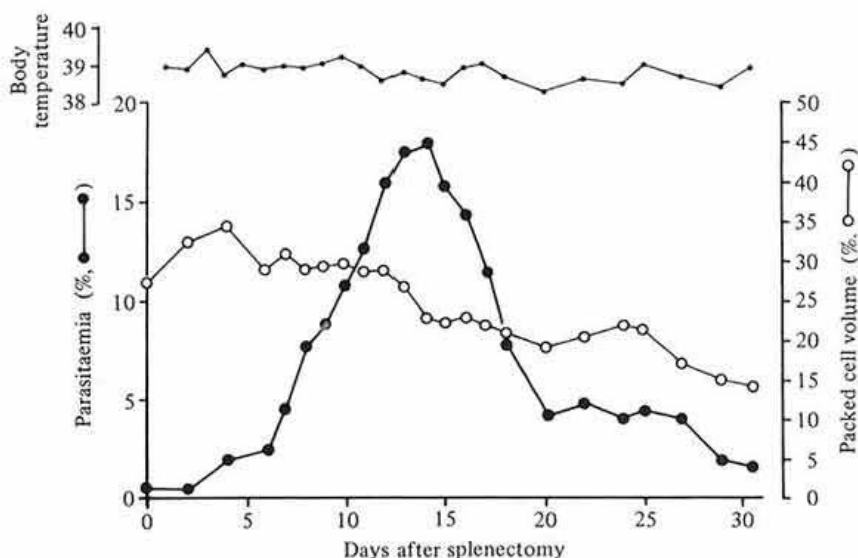


Fig. 2. Variations in parasitaemia, packed cell volume and body temperature in a calf infected with *Theileria* after splenectomy

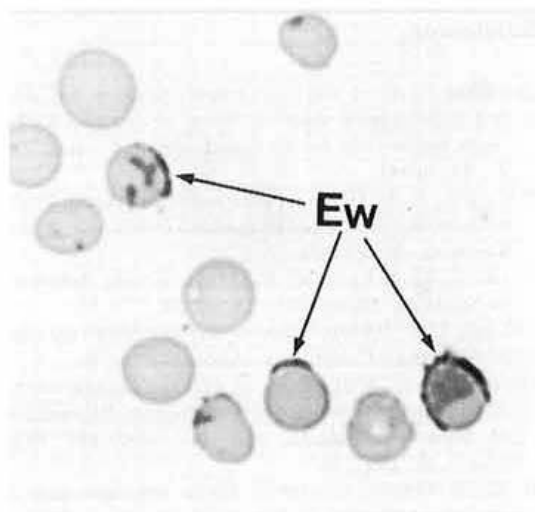


Plate 2. Blood smear of a splenectomized calf showing *Eperythrozoon wenyoni* (Ew) Giemsa staining. ($\times 1,250$)

volume (less than 20%), 23 cattle were considered anaemic.

2) Pathogenicity

Fig. 2 shows the changes in parasitaemia, packed

Table 2. Tick collection in different areas in Perak, Peninsular Malaysia

Location	Tick species	
	<i>Boophilus microplus</i> ^{a)}	<i>Haemaphysalis bispinosa</i>
Cattle	512 (46 ♂, 377 ♀, 85N, 4L)	8 (4 ♂, 2 ♀, 2N)
Grass	few* (L)	0

Parenthesis shows the number in each stage of ticks. a): N; Nymph, L; Larva, *; Not counted.

cell volume and body temperature in the splenectomized calf. The peak parasitaemia (17.9%) was observed at the 14th day after splenectomy and at the same time there was a marked reduction in packed cell volume without pyrexia. The blood parameters on the 20th day showed the erythrocyte counts, haemoglobin content and packed cell volume of $4.52 \times 10^6/\mu\text{l}$, 5.7 g/dl and 19.0%, respectively.

On the 22nd day after splenectomy, the calf developed a transient infection of *Eperythrozoon wenyoni* (Plate 2). Less than 1% of erythrocytes was infected, but the percentage of the infected cells increased rapidly for the next four days. Thereafter, *E. wenyoni* had disappeared from the circulation.

3) Tick collection

Results of the tick collection are shown in Table 2. Most of the ticks collected from the cattle were *Boophilus microplus* (larvae, nymphs and adults), and only two nymphs, four adult males and two adult females were of the *Haemaphysalis bispinosa*. Only very small number of *B. microplus* was found in the form of unfed larvae on the grasses.

Discussion

The piroplasms detected in the smears were morphologically indistinguishable from those of *T. sergenti*/*T. orientalis* group of parasites and were similarly associated with the intraerythrocytic bar and the veil structure which were known to occur in infections caused by parasites of this group. It was presumed that the presence or absence of the intraerythrocytic bar or veil structure was due to Giemsa staining reaction rather than to mode of the infection.

The classification of *T. sergenti*/*T. orientalis* is still controversial. The well known name, *T. mutans*, has been used in Malaysia since 1958⁴. The African strain of *T. mutans* is not associated with bar or veil structures in the affected erythrocytes⁸. *Amblyomma* tick is as known the main vector of *T. mutans*, while the association of *Amblyomma* tick with cattle is negligible or none at all in Peninsular Malaysia³. For these reasons, *T. mutans* may not be an adequate name of this parasite. Morel and Uilenberg⁵ proposed *T. orientalis* for the benign *Theileria* of cattle in Eurasia based on their philological study. On the other hand, Callow² proposed *T. buffeli* as a species name of the causal agent of the bovine theileriosis in Australia, since the Australian *Theileria* recognized as *T. sergenti* demonstrated to be transmissible by blood from buffalo to cattle¹. There has been no study on taxonomy of Malaysian *Theileria*, though Fadzil and Ragavan³ used the name of *T. orientalis* in their report. Rajamanickam⁶ stated that what was referred to as *T. mutans* in this region might be *T. orientalis* or even *T. buffeli*.

Regardless of the arguments centering around this particular piroplasm taxonomy, there is little doubt that it is relatively benign. Usually infections are subclinical, though heavily parasitized or splenec-

tomized animals may develop severe anaemia. In the present study, the splenectomized calf showed anaemia at the time when there was high parasitaemia. In Peninsular Malaysia, the sole cause of the anaemia by *Theileria* (*T. sergenti*/*T. orientalis*/*T. buffeli*) is questionable, particularly in the splenectomized calf infected in a mixed manner of *E. wenyoni*, which is known to cause anaemia in splenectomized calves⁷.

The effect of the infection by *Theileria* on the cattle production in Malaysia cannot be evaluated adequately without a better understanding of its pathogenicity. It might be an additional cause of disease. Further research on the pathogenicity of the Malaysian *Theileria*, its epidemiology and transmission is therefore required.

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