



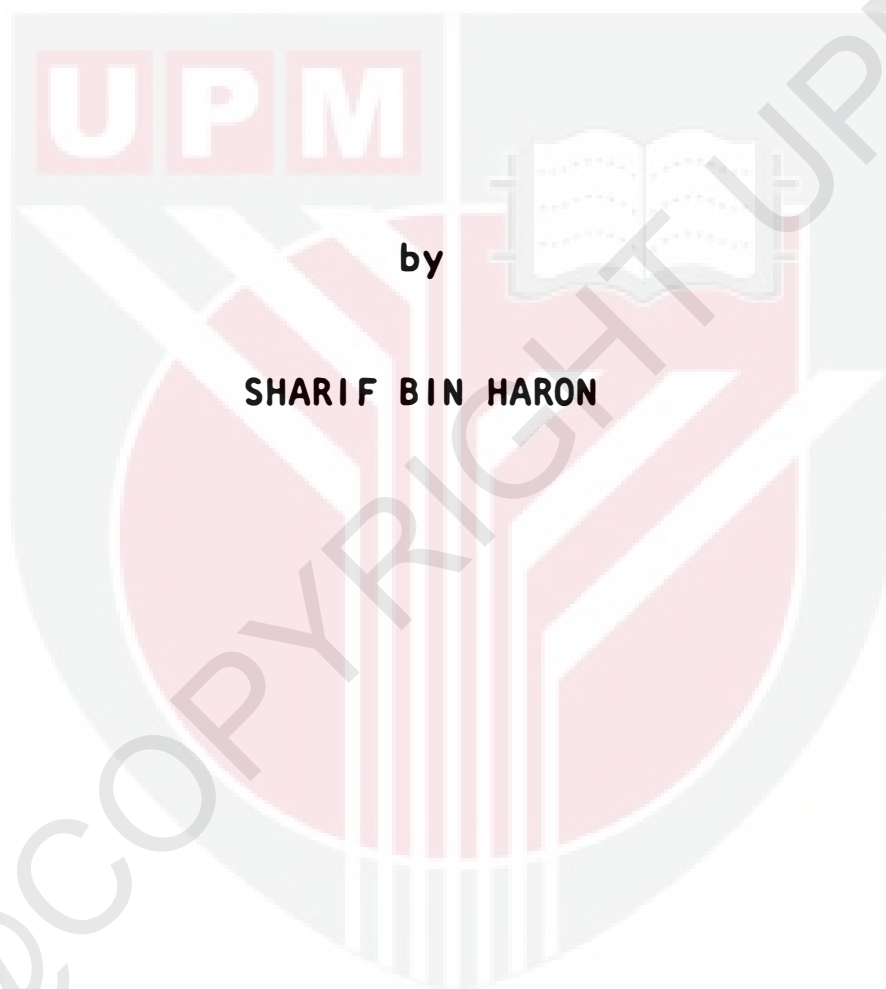
**UNIVERSITI PUTRA MALAYSIA**

**A STUDY OF TICK INFESTATION AND TICK IDENTIFICATION  
IN VARIOUS BREEDS OF CATTLE AND BUFFALOES  
UNDER DIFFERENT MANAGEMENT SYSTEMS**

**SHARIF BIN HARON**

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IN VARIOUS BREEDS OF CATTLE AND BUFFALOES  
UNDER DIFFERENT MANAGEMENT SYSTEMS**



by

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**A project report submitted in partial fulfilment of  
the requirement for the degree of Doctor of Veterinary Medicine  
(D.V.M.) in the Faculty of Veterinary Medicine and Animal Science,  
Universiti Pertanian Malaysia, Serdang, Selangor.**

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## ABSTRACT

An assessment of the degree of tick infestation in cattle and buffaloes is described.

Result of the study showed a very significant breed difference ( $p < 0.01$ ) and individual variations to tick infestation. The mean tick counts tended to be greater in the exotics, followed by crossbreds and locals in this order. It also indicated a very significant difference in tick infestation with different management systems ( $p < 0.01$ ). No ticks were found on buffaloes in this series.

*Boophilus microplus* and *Haemaphysalis bispinosa* were the cattle ticks identified.

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## INTRODUCTION

Cattle and buffaloes, like many other domestic animals face the problem of internal and external parasitism and the tick is one of the many parasites considered of economic importance. The losses caused by ticks are in two forms; the direct effect of the tick burden itself and the effect of diseases transmitted by ticks as vectors.

The maintenance of a high tick population in any area would depend on breed resistance, stocking rate, type of management systems and the climate. Different breeds have different ability to acquire resistance to the local ticks and their tick-borne diseases.

The types of cattle ticks and their geographical distribution have been studied but no detailed studies were undertaken as regards its variation in infestation in breeds of cattle and buffaloes of Malaysia. It is the objective of this preliminary study to identify the types of ticks in cattle and buffaloes, to compare the infestation on these animals and its variation under different management systems.

It pursuing the study, various problems were encountered, mainly because it is often difficult to count the number of ticks on cattle and buffaloes directly, either due to the large numbers present or the lack of co-operation on the part of the animals.

## LITERATURE REVIEW

As early as 1957, 23 species of ticks were recorded by Kohls in West Malaysia and Borneo. One of them, *Amblyomma testudinarium* was collected from the water buffalo (cited by Rajamanickam, 1967). Many reports on the presence of cattle ticks, *Boophilus microplus* and *Haemaphysalis bispinosa* have been published. (Legg, 1959; Audy, Nadchartum and Lim, 1960; Rajamanickam, *et al* 1967 and Camoens, 1977). Rajamanickam, *et al* (1967) recorded cattle ticks mentioned above as well as *Rhipicephalus sanguineus* and have also detected *Amblyomma testudinarium* from one farm on a small number of imported cattle. Camoens, *et al* (1977) later suggested that *Amblyomma testudinarium* which he identified on the domestic buffalo was actually transferred from cattle.

Many reports of the difference in susceptibility to tick infestation between and within breeds have been published. (Riek, 1962; Wilkinson, 1962; Francis and Little, 1964; Siefert, 1971; Wagland, 1975 and Utech, Wharton and Kerr, 1978). The European breeds, *Bos taurus* are fairly susceptible to tick infestation. The indigenous cattle, the Local Indian Dairy (LID) and Kedah-Kelantan (KK) which are very well adapted to the local condition were more resistant to tick infestation as observed by the presence of few ticks on these cattle. Some individuals within the same breed are far more resistant to infestation than the remainder of the herd and some rarely carry ticks. The average *Bos indicus* breed

carry a quarter to a fifth of *Boophilus* ticks carried by *Bos taurus*. The breed differences within the zebu crossbreeds have generally been non-significant (Hewetson, 1976).

In Malaysia, Thailand and Philippines, *Bos indicus* cattle are infested with small numbers of cattle tick, *Boophilus microplus* (usually less than ten engorged females per animal). However, the level of infestation is evidently sufficient to maintain transmission of *Babesia argentina* and *Babesia bovis*<sup>1</sup> since blood parasites are present in the indigenous cattle (cited by Hewetson, 1977). Cattle deaths due to tick-borne diseases in Malaysia account up to 32% either due to anaplasmosis or babesiosis (Camoens, *et al* 1977).

## MATERIALS AND METHODS

### Animals

This preliminary study analysed the tick counts made on various breeds of cattle and buffaloes at Universiti Pertanian Malaysia farms and those belonging to farmers in Serdang area. All animals were either exotics, crosses or locals reared under extensive, semi-intensive or intensive systems of management. The buffaloes consisted of Swamp and Murrah breeds from extensive and semi-intensive management systems.

<sup>1</sup> *Babesia argentina* is now recognised as *Babesia bovis*

## A method of counting the tick numbers

The data was collected within a period of six weeks between November 7th, 1981 to January 17th, 1982. Counts were made almost at the same time of the day, between 9.00 am to 1.00 pm. A random sampling was adopted.

To assist in counting, these animals were examined in a crush and in some cases, they were held by rope in the presence of the owner and this allowed all areas to be searched carefully. Counts were made visibly and by palpation. A procedure suggested by Wharton and Utech (1970) (cited by Wharton, Roulston, Utech and Kerr, 1970) was adopted in this study. Initially, assessment to the degree of tick infestation was based on counting the number of female ticks 5 mm or more in length (Wilkinson, 1962). Later, it was considered that cattle and buffaloes could be ranked more precisely on the basis of counts of engorged females in the range of 4.5 mm to 8 mm in length (excluding the capitulum) on one complete side of the animal (right side including the back). The count was doubled to give the total population with an assumption that infestation is symmetrical. Ticks of this size engorged overnight and dropped the following morning. 4.5 mm is also the size of tick near mature size and the smallest visible size in the field.

## Identification of ticks

Specimens of ticks were collected with the aid of curved forceps placed as close to the body as possible. Specimens were kept in 70%

alcohol for identification under a stereomicroscope. Pictorial key to the identification of Ticks (Appendix I).

The approach described in this paper to the assessment of tick infestation requires quiet animals, good facilities for their examination and careful observation for counting the ticks. Under these conditions it was possible to obtain a reasonable accurate assessment in the field.

## RESULTS

### Tick infestation on cattle

The distribution of tick counts was examined and it showed that the tick counts have a strongly skewed distribution. All results herein were analysed and presented in its actual form.

Table 1 : Mean Tick Counts of Exotic Breed

| Breeds          | n  | mean + s.d.     | range  |
|-----------------|----|-----------------|--------|
| Friesian        | 11 | 138.35 ± 119.72 | 34-392 |
| Jersey          | 9  | 59.22 ± 36.98   | 19-126 |
| Santa Gertrudis | 15 | 7.87 ± 7.34     | 0- 26  |
| Brahman         | 29 | 21.72 ± 16.45   | 4- 45  |
| OVERALL         | 64 | 43.80 ± 67.72   | 0-392  |

NB. ANOVA test revealed a very significant breed difference among the exotics ( $p < 0.01$ ).

The purebred Friesian had the highest tick count and carried significantly more ticks than the rest of the exotic cattle. It should be noted, however, that the purebred Santa Gertrudis have been deticked five days before the count was made.

Table 2 : Mean Tick Counts of the Crossbreds

| Breeds             | n  | mean + s.d.   | range |
|--------------------|----|---------------|-------|
| Friesian X Sahiwal | 11 | 58.09 + 31.43 | 19-89 |
| Hereford X         | 35 | 10.34 + 10.13 | 2-34  |
| LID X Shorthorn    | 2  | 10.15 + 7.78  | 5-16  |
| Friesian X LID     | 18 | 25.06 + 17.21 | 2-61  |
| Jersey X LID       | 4  | 18.50 + 14.06 | 3-34  |
| OVERALL            | 70 | 29.19 + 24.18 | 2-89  |

NB. ANOVA Test revealed a very significant breed difference among the crossbreds ( $p < 0.01$ ).

The numbers of tick observed on the crossbreds are shown in Table 2. Friesian-Sahiwal had the highest tick count among the crossbreds. It should be noted, however, that the Hereford crosses had been deticked five days before the tick count was made. Remnants of ticks were observed on cattle of this breed.

83.6% of the Kedah-Kelantan (KK) cattle and 46.5% of the Local Indian Dairy (LID) cattle carried no ticks and most of them carried few ticks. The mean tick count was eight times more in the LID than in the KK breed (Table 3).

Table 3 : Mean Tick Counts of the Local Cattle

| Breeds                   | n   | mean + s.d.  | range |
|--------------------------|-----|--------------|-------|
| Kedah-Kelantan (KK)      | 110 | 0.91 + 2.45  | 0-15  |
| Local Indian Dairy (LID) | 157 | 8.89 ± 14.25 | 0-74  |
| OVERALL                  | 267 | 5.58 + 12.61 | 0-74  |

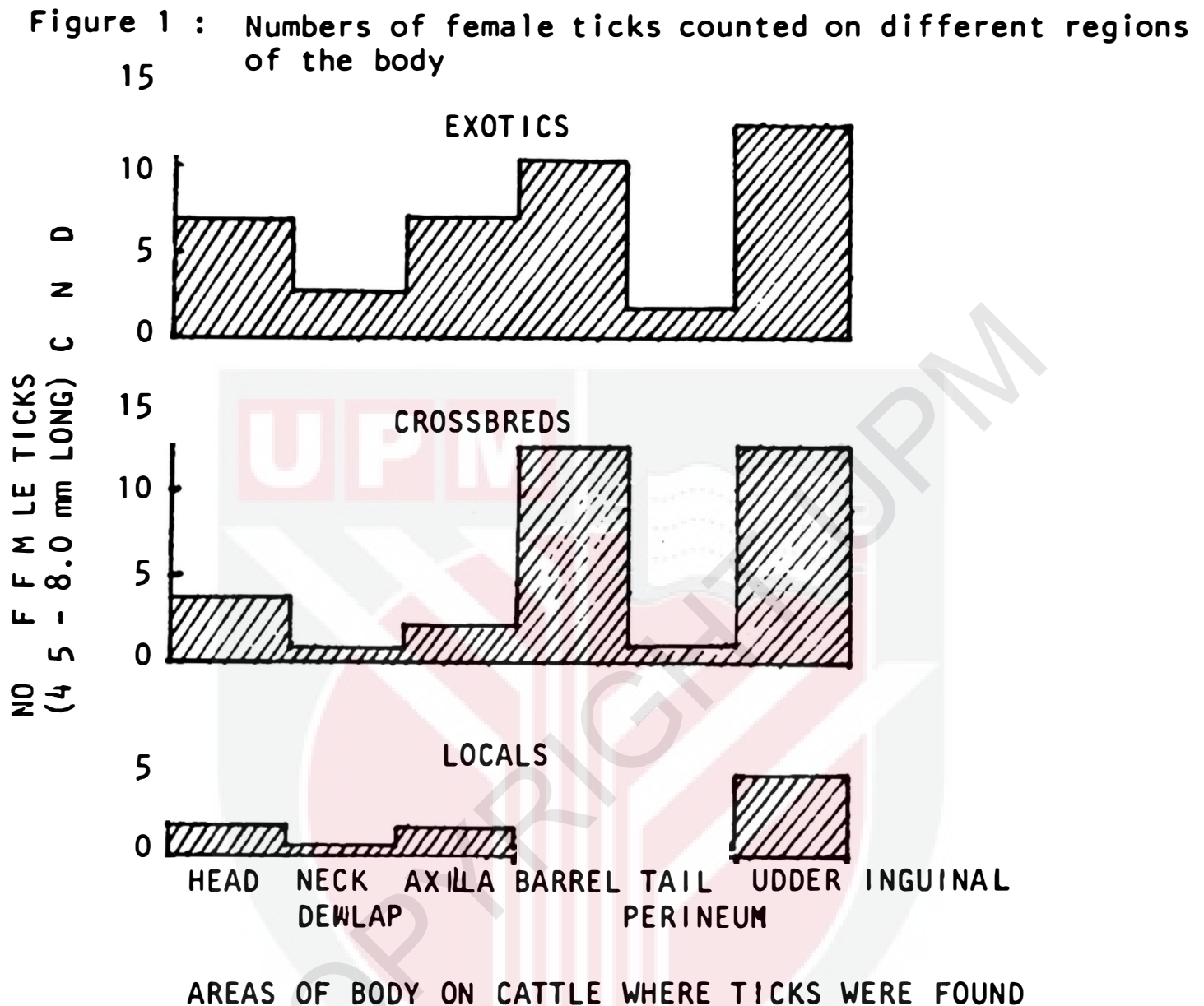
NB. ANOVA Test revealed a very significant breed difference among the local cattle ( $p < 0.01$ ).

#### Breed Differences

The level of tick infestation was significantly higher in the exotic breeds and lowest in the local cattle (Table 1,2 and 3). The mean tick counts were 8 and 1.5 times higher in the exotics than the locals and crosses respectively.

The result indicated that among the exotic breeds, tick counts were highest in the Friesians, followed by Jerseys, Brahmans and S. Gertrudis in this order. Among the crossbreds, Friesian-Sahiwal were the highest followed by combined LID X British breeds crosses and Hereford crosses. Among the local breeds comparison between KK's and LID's showed that the KK's had significantly lower tick counts than the LID's. All the differences were significant at the 1% level.

### Distribution of ticks on cattle



Some conclusion might be drawn from figure 1. Ticks were present on all areas of the body, with the largest number on the udder and inguinal, barrel, head, axilla and also a considerable number on the neck, dewlap, tail and perineum. In the case of the local breeds, the barrel did not seem a favorite place for lodging.

### Tick infestations under different management systems

Cattle reared under intensive system carried significantly lower ticks than those under extensive and semi-intensive systems. Results of counts in extensive and semi intensive systems are confounded because

of an interaction between breed difference and management systems (Table 4).

Table 4 : Mean Tick Counts under Different Management Systems.

| systems        | n   | mean + s.d.   | range |
|----------------|-----|---------------|-------|
| Extensive      | 250 | 5.91 + 10.42  | 0-74  |
| Semi-intensive | 104 | 42.16 ± 55.36 | 0-392 |
| Intensive      | 116 | 0.46 ± 1.37   | 0-9   |

NB. 1. ANOVA Test revealed a very significant difference in tick infestation to different management systems ( $p < 0.01$ ).

2. Definition adopted were :-

- a. Intensive-animals that were stall-fed and did no grazing at all although some would be fed cut and carry forage.
- b. Extensive-animals grazing entirely without any supplement
- c. Semi-intensive was intermediate with night housing and day time grazing over an area.

### Tick Infestation in Buffaloes

Although no ticks were found on 119 buffaloes belonging to Swamp and Murrah breeds in this series, *Boophilus* specimens have been collected from buffaloes on a small holder land in this area (L.K. Whitten, personal communication 1981).

### Tick Identification

Two most important ticks from the study appeared to be *Boophilus*

*microplus* and *Haemaphysalis bispinosa*. *B. microplus*, the commonest tick in domestic animals of this country was identified from all breeds of cattle studied except from a group of Local Indian Dairy cattle which had *H. bispinosa*. *H. bispinosa* was also detected from the beef herd consisting of S. Gertrudis, Hereford crosses, Brahman and KK cattle. *H. bispinosa* is occasionally found as a mixed infestation.

#### DISCUSSION

Assessment of the degree of tick infestation could be based on counting the number of ticks within a specified range. Counting on one complete side of the body including the back was found to be relatively constant.

The findings from the study are in agreement with previous work done by other workers (Riek, *et al* 1962; Wilkinson, *et al* 1962; Francis and Little, *et al* 1964; Seifert, *et al* 1971 Wagland, *et al* 1975 and Utech, Wharrton and Kerr, *et al* 1978). It was evident that there is a very significant breed difference in cattle to tick infestation. There is also a considerable variation in individual members of a breed indicated by a wide range in tick count. Some individuals carried high tick count while some harboured few ticks or barely no ticks. The exotic breeds carried significantly more ticks than other breeds. The local breeds (KK and LID) had a high degree of tick resistance and hence, carried low tick count. A very significant breed difference existing among the crossbreds contradicts to a report that the breed difference within the zebu crosses have generally been non-significant (Hewetson, *et al* 1976)

It was documented that the purebred zebus were highly resistant to tick infestation and they passed this characteristic to their descendants almost in direct proportion to the percentage of zebu 'blood'. The difference in the percentage of zebu blood in the crossbreds studied might have contributed to the difference in findings as regards to tick infestation among the crosses. The relatively low tick counts in Santa Gertrudis and Brahman is associated with the zebu blood in these breeds.

A number of physiological factors were thought to affect the tick counts and its life cycle. These were sex, age, stage of lactation, pregnancy and the status of animal health (Wharton, Utech and Turner, 1970; Seifert, *et al* 1971 and Hewetson, *et al* 1977).

Estimates of the tick counts were made in a short period of time and hence, it has to be considered whether the cattle was protected following acaricidal treatment. Two groups of cattle (Hereford crosses and Purebred Santa Gertrudis) were subjected to deticking five days prior the tick count. The low counts in these two breeds might be related to the acaricidal treatment. A routine deticking programme of two weeks interval (Asuntol<sup>R</sup> 0.1% spray)<sup>2</sup> was carried out in bigger herds (UPM) especially with the exotics. There was also a considerable increase in the frequency of deticking with increase in infestation. All farmers, except two, did not practise any deticking programme. Two farmers used

<sup>2</sup>Asuntol<sup>R</sup> is an acaricide with 0,0-Diethyl-0-phosphorothionate as its active ingredient. Bayer product.

Agrocide<sup>R 3</sup> as a deticking agent. The most important implication from this study is that the exotics and some crossbreeds need a regular deticking programme as often as two weeks interval. The local breeds on the other hand never have to be sprayed. The result also indicated that crossing of *Bos taurus* with *Bos indicus* reduced the degree of tick infestation.

There is usually little host specificity to tick infestation and the host range may be fairly wide. Frequently certain hosts are best suited to a species development. Most ticks will attach to any part of the host's body but usually show a preference for certain areas. From the study, ticks frequently preferred the areas of the softer skin and the more secure areas, such as the udder and inguinal, axilla and the head particularly the eyelids and the ears. The survival of ticks on these places reflected the inefficiency of the deticking programme. There seemed to be a corresponding increase of tick numbers on the head, axilla udder and inguinal as the total population of ticks on the animal increases. Only when the animal is heavily infested with ticks, there is high tick count on less secure areas such as the barrel, otherwise, it is not a favourite place for lodging (Figure 1). Distribution of ticks on the host is important with regards to deticking programme. In deticking, more attention should be given to such areas as the udder, inguinal, axilla and the head (eyelids and ears) for these are the areas where ticks are securely lodged.

<sup>3</sup>Agrocide<sup>R</sup> is an insecticide containing 40% BHC. ICI product.

Biotic factors such as density of population and the type of management systems and abiotic factors such as rainfall, ambient temperature and relative humidity markedly influence the tick infestation and the distribution of tick species. Any locality that does not receive at least 500 mm of rainfall per annum, 85% of relative humidity and 20-30°C ambient temperature is unsuitable for the tick (Legg, *et al* 1959 and Wilde, 1976). Malaysia has a rainfall of above the 500 mm limit in most areas and the climatic conditions for the tick life is almost ideal (Appendix II). It was thought also that the degree of tick infestation at a given time was positively related to rainfall three months previously (Francis and Little, *et al* 1964). In this case, the peak rainfall was five months prior the study. Cattle reared under intensive system are less infested with tick compared to those under semi-intensive and extensive systems, since infestation is naturally through the pastures. Greater density of cattle population also determines the degree of infestation. When the stocking rate is greater, the larval ticks have a greater chance of reaching a new host.

A routine deticking programme, high tick resistance among the local cattle, crossing of *Bos taurus* with *Bos indicus* and the presence of cattle egrets (*Ardeola ibis coromonda*) or locally called bangau throughout the time of the study, may be the answer to the low tick infestation. The love for wallowing in swampy and muddy areas may be a contributing factor for the absence of tick in buffaloes.

Caution has been made that stock owners and veterinarians should be alert for the variation in degree of tick infestation. The breed difference, distribution of ticks, frequency of deticking and the life history greatly influence the method of deticking to be adopted and the efficiency of control of tick infestation.

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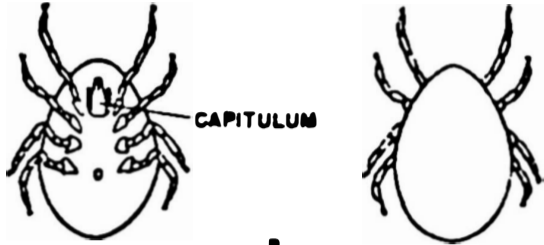
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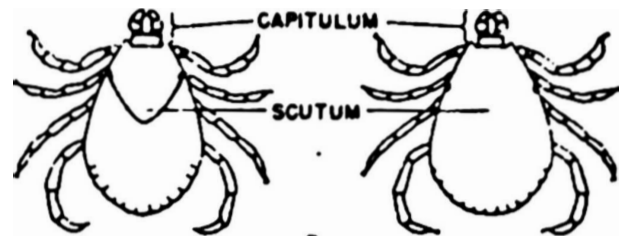
APPENDIX I

PICTORIAL KEY TO THE IDENTIFICATION OF TICKS  
(after Macy and Berntzen, 1971)

Capitulum inferior; scutum absent  
FAMILY ARGASIDAE



Capitulum anterior; scutum present  
FAMILY IXODIDAE



Female, dorsal

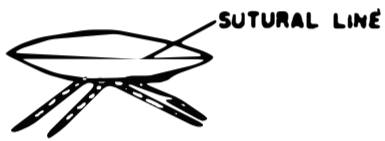
Male, dorsal

Margin of body with definite sutural line

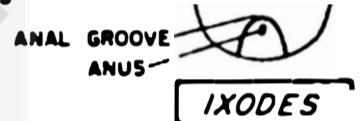
Margin of body thick, rounded, without definite sutural line

Anal groove either behind anus indistinct, or absent

Anal groove in front of anus



ARGAS



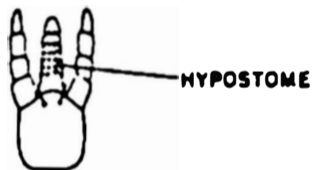
IXODES

Hypostome with well-developed teeth. Integument momillated

Hypostome vestigial or without effective teeth. Integument tuberculated or granulated

Mouthparts as long as basis capituli. Second segment of palpi as long as wide

Mouthparts much longer than basis capituli. Second segment of palpi twice as long as wide



ORNITHODOROS



ANTRICOLA



AMBLYOMMA

Second segment of palpi not laterally produced

Second segment of palpi laterally produced



HAEMAPHYSALIS

Basis capituli laterally produced

Basis capituli not laterally produced



BASIS CAPITULI

Fore coxa not deeply cleft

Festoons absent. Anal groove indistinct

Fore coxa deeply cleft

Festoons present. Anal groove distinct

Festoons eleven

Festoons seven



BOOPHILUS



RHIPICEPHALUS



DERMACENTOR



ANOCENTOR (OTOCENTOR)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
PUBLIC HEALTH SERVICE  
COMMUNICABLE DISEASE CENTER  
ATLANTA, GA., DECEMBER 1948

REV NOV 1951  
REV MAY 1953

APPENDIX II

Temperature, Rainfall and Relative Humidity  
at Universiti Pertanian Malaysia  
Serdang, Selangor

Latitude : 3° 02' N

Longitude : 101° 42' E

Height above sea level : 31 m

