UNIVERSITY OF NAIROBI

SURVEY OF SPECIES OF TICKS INFESTING CATTLE ON KANYARIRI VETERINARY FARM, UNIVERSITY OF NAIROBI

A project report submitted in partial fulfillment of the requirements for the Degree of Bachelor of Veterinary Medicine of the University of Nairobi

By

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DECLARATION

I hereby declare that this project report is my original work and has not been submitted or presented, to the best of my knowledge, to any other institution for the award of any degree:

SIGNED: ……DATE…….....

This project report has been submitted for examination with the approval of University supervisor:

SIGNED: ……DATE…….....

DEDICATION

To my family, I really appreciate you for all the support, guidance and encouragement you have given me throughout my academic life. You have moulded me into the person I am today. I will always be indebted to you for all you have done for me. May the Almighty bless you abundantly.

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to God Almighty for His sufficient grace in my life. I also wish to thank my supervisor,Professor N.Maingi for his intellectual advice, informed suggestions, professional guidance and for his patience throughout the entire project work.

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God bless you all.

ABSTRACT

A survey of ticks affecting dairy cattle at the University of Nairobi, veterinary farm at Kanyariri, was performed from January to March 2015. The farm is a mixed farm with dairy, poultry, sheep and piggery units and focuses more on the dairy unit for profit. The ticks were collected from four areas of the body of cattle, identified as region A (head, neck and brisket), region B (belly and back, region C (udder and legs), region D (anal region and tail). The ticks were put in labeled plastic vials containing 70% ethanol and transported to the Parasitology Laboratory, Department of Veterinary Pathology, Microbiology and Parasitology for identification using morphological features. A total of 146 adult hard ticks (Ixodidae) were collected from 20 dairy cattle. The overall prevalence of the ticks was calculated by dividing the number of positive samples by the total sample size and multiplied by 100. Out of the 20 animals examined, ticks were found on 19 animals yielding an overall prevalence of 95%. Most ticks (41%) were found in region B of the animal and the ratio of ticks in the four regions A: B:C:D was 2:3:2:1, respectively. Two species of ticks were identified; *Boophilus decoloratus and Rhipicephalus appendiculutus.* The most abundant species was *Boophilus decoloratus* at 86.3%. The ratio of *Boophilus decoloratus: Rhipicephalus appendiculutus* was 6:1. The competence of the ticks as vectors for pathogens and their economic importance are discussed.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Ticks are serious vectors of human and animal disease agents; transmitting a greater variety of infectious organisms than any other blood sucking arthropod. Ticks are known to transmit numerous protozoan, viral, bacterial and fungal pathogens. Ticks can be injurious to domestic animals due to the loss of blood that can occur when a large number of ticks feed. Secondary infections can occur at the feeding sites and diminish the value of livestock from the damage to the hides (Estrada-Pena, 2001; Urquhartetal.,1996). Ticks have four stages in their lifecycle; the egg, larva, nymph and adult (Minjauw and McLeod, 2003). All ticks feed on blood during the larva, nymph and adult stages. They have remarkably long lives with many surviving for one or more years without feeding. Most ticks that attack domestic livestock are in the family Ixodidae, the group referred to as hard ticks. In the family Argasidae (soft ticks), there is one species that is damaging to cattle, the spinose ear tick (*Otobius megnini*) (Hendrix, Charles M. 1998).The most common genera of hard ticks in Kenya are Rhipicephalus, Boophilus, and Amblyomma(Mukhebi et al., 1992). The most common species of *Boophilus* (the blue tick) is *B. decolatus. Rhipicephalus* species infesting cattle include the brown ear tick (*R. appendiculatus*) which carries pathogen (*Theileria parva*) responsible for transmitting east coast fever. The genus Amblyomma has two important species affecting cattle, *A. variagatum* and *A. gemma*. The two species transmit *Rickettsia* (*Cowdria*) *ruminantium* the causative agent of heart water among others. The spinose ear tick is in the genus Otobius, the adults do not feed but the young are found in the auditory canals of cattle (Hendrix, Charles M. 1998). No previous studies have

been conducted to establish the species of ticks affecting cattle at the University of Nairobi, Kanyariri veterinary farm.

1.2 Justification

University of Nairobi veterinary farm, Kanyariri is a mixed farm with dairy cattle, poultry, pigs and sheep units.The cattle in the farm are 265. It was noted that despite use of different acarides in the farm,there were ticks that were not responding to the acaricides. The farm focuses on dairy cattle milk productin to generate profit and with the farm encountering tick resistance to acaricides, tick borne diseases may soon become a major problem reducing productivity and causing major losses. Some of the steps towards development of sustainable control strategies for the ticks is to identify the species of ticks and the acaricides to which they are resistant. This study was done to determine the species of ticks infesting cattle on the farm. This information is currently not documented.

1.3 Study objectives

General objective:

To determine the species of ticks infesting cattle on Kanyariri Veterinary Farm, University of Nairobi.

Specific objectives:

1. To determine the species of ticks on various regions of the body of cattle on Kanyariri Veterinary Farm.

2.To determine the relative occurence of the species of ticks on the cattle.

1.4Hypothesis

Ho there are no ticks on the animal in the farm

H1 there are ticks on the the animals in the farm.

Ho there are no different species of ticks on the animals

H1 there are different species of ticks on the animals.

CHAPTER TWO: LITERATURE REVIEW

Ticks and tick borne diseases (TTBDs) are widely distributed throughout the world, particularly in tropical and subtropical countries. It has been estimated that 80% of the world cattle populations are at risk from TTBDs and that they annually cause US$ 7 billion worth of losses (McCosker, 1979).

The tick species that cause the most serious problems for all livestock producers, rich and poor, can be divided into 4 groups (Mukhebi et al., 1992):

1**. Boophilus spp**. That transmit the protozoan Babesia spp. and the rickettsia *Anaplasma* spp. The species are widely distributed and their most significant impact is on imported and exotic breeds of cattle.

2. **Hyalomma spp**. that transmit the protozoan *Theileria annulata* that causes Tropical theileriosis, which is a particular problem for crossbred dairy cattle in the Mediterranean region, India and worldwide it is estimated that 250 million cattle are at risk to this disease.

3. **Amblyomma species**, that transmits the rickettsia *Cowdria (Ehrichia) ruminantium* the causative agent ofheartwater, a disease of small ruminants and exotic cattle in sub-Saharan Africa (SSA).

Amblyomma spp. also transmit the protozoan *Theileria mutans* and have been identified as a cause of benign bovine theileriosis, which is a significant problem in West Africa. The species of this tick are also associated with tick worry or damage.

4**. Rhipicephalus spp**. that transmit the protozoan *Theileria parva* which causes East Coast Fever (ECF), a serious disease responsible for widespread morbidity and mortality among cattle in 11 countries in Eastern, Central and Southern Africa (ECSA) and affects Approximately 24 million cattle Dairy cattle smallholder farmers in Kenya identify TTBDs, particularly ECF, as a major problem in terms of the risk and the high cost of treatment. In the Western Highlands of Kenya, Onieke (1999) reports that ECF and anaplasmosis are major problems for cattle owners, particularly in the peri-urban areas. In Southern Malawi where ECF is not prevalent, babesiosis and anaplasmosis are reported to be the major cause of death among dairy cattle (Tjornehoj *et al*., 1997). A survey on the island of Pemba in Tanzania revealed the widespread presence of *Babesia bovis* and *B.bigemina* among zebu x Jersey crosses or New Zealand milking zebu, bred in the area. The absence of clinical outbreaks of disease suggests that a state of endemic stability exists (Woodford *et al*., 1990). Gitau *et al*. (1997) in a study of smallholder dairy farms in Central Province of Kenya found that the antibody prevalence for *T. parva* ranged between 18 and 72%, for *T. mutans* between 1.5 and 28% and *B. bigemina* between 12 and 49%. The authors state that in some agro-ecological zones these TBDs appear to be in a state of endemic stability. Gitau *et al*. (1999; 2000) found that systems of grazing in highland Kenya had an effect on antibody prevalence of ECF and on ECF morbidity and mortality risks. Cattle in open grazing had higher ECF antibody levels and were at greater risk of contracting ECF than those in zero-grazing systems.

The most common TBDs in India are tropical theileriosis, babesiosis and anaplasmosis. Control of tropical theileriosis remains a national priority, with research programs devoted to the development of vaccines for this disease (Minjauw and McLeod, 2000). Tick worry caused by

high levels of infestation with *Hyalomma spp*. and *Boophilus spp*. during the rainy season appears to be the primary concern of poor dairy farmers (Minjauw and McLeod, 2000).

Recent research in Kenya has indicated that resource-poor herders and farmers spend a large proportion of their income treating endemic diseases (Heffernan and Misturelli, 2000).

However, little is known about the wide-scale potential impacts of such diseases and the scope for new technologies to aid the poor.

In a study on Rusinga Island in Western Kenya, zebu cattle were kept under traditional husbandry conditions without chemical tick control. Latif *et al*. (1995) report that *Babesia bigemina* and *Anaplasma marginale* were present but no deaths were recorded. ECF, however, Accounted for 21% of calf deaths. Indeed, the average mortality rate in calves up to 22 months was 33%. As such, it is considered that ECF would be a major constraint to the introduction of improved breeds to the island. Many authors write of the opportunity costs of TBD on the aforementioned production systems by preventing the introduction of more productive animals (Uilenberg, 1996).

A study of TBDs by Deem et al. (1993) in the Coast Province of Kenya found that prevalence rates of *T. mutans, B. bigemina, A. marginale* and *C. ruminantium* were high and very similar across four agro-ecological zones, but prevalence rates for *T. parva* ranged from22–85%. The authors suggest that under these circumstances there is justification to vaccinate

Zebu cattle in some of the agro-ecological zones, demonstrating the need for local data and information before making decisions on control strategies for TBDs.

TTBDs are an increasing problem for pastoralists in East Africa. Although traditional pastoral areas are on the margins of the habitats suitable for ticks, constraints to the movement patterns of pastoralists can mean that animals face an irregular challenge from TTBDs and may become

infected as they move to dry-season grazing. For example, de Leeuw et al. (1991) reported outbreaks of theileriosis in cattle and Nairobi sheep disease in small ruminants when the Masaai moved their stock to affected areas to escape drought.

CHAPTER THREE: MATERIALS AND METHODS

3.1 AREA OF STUDY

The study was conducted at the University of Nairobi Veterinary farm, which is located on a 375 acre piece of land in Kanyariri village of lower Kabete. It is 2 Kilometers of upper Kabete campus and 15 Kilometers from Nairobi city astride the Fort Smith itself. The farm keeps a herd of dairy cattle, a flock of doper sheep, a piggery unit and layer poultry unit. The farm is mainly a teaching facility of the Faculty of Veterinary Medicine and Faculty of Agriculture at the University of Nairobi.

3.2 EQUIPMENTS AND MATERIALS.

- 70% alcohol

-Plastic vials

-Marker pen

-Gloves

-Light microscope

- Thumb forcep

3.3 STUDY ANIMALS AND SAMPLING METHODS

The study animals were dairy cattle. A total of 20 animals were selected by systematic random sampling technique for tick collection and identification. The total sample size for the study was estimated by the formula by Thrusfied (1995):

$N=1.96^2(1-P)/D^2$

Where N=Sample Size

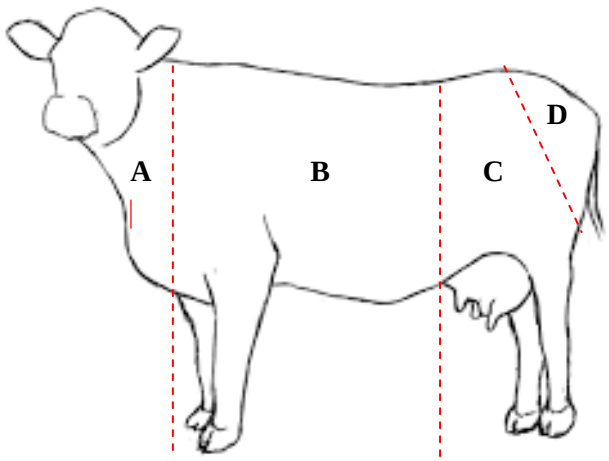
P= Minimum estimated prevalence= 50%

D= Expected outcome 5%

3.4 TICK COLLECTION.

After the selected cattle were restrained adult ticks were collected from half-body regions and put in plastic vials containing 70% ethanol (Walker et al., 2003) and labeled. The body regions used for tick collection are marked in Figure 1 and were head, neck and brisket (region A), belly and back (region B), udder and legs (region C), anal region and tail (region D). Ticks were removed from the host skin whilst retaining their good condition for identification. The adult ticks collected from each body regions were kept in separate sample bottles (Figure 2 and 3) and then transported to the University of Nairobi, upper kabete campus Parasitology Laboratory for identification. The total number of ticks collected was recorded.

Figure 1: Body Regions for Tick Collection



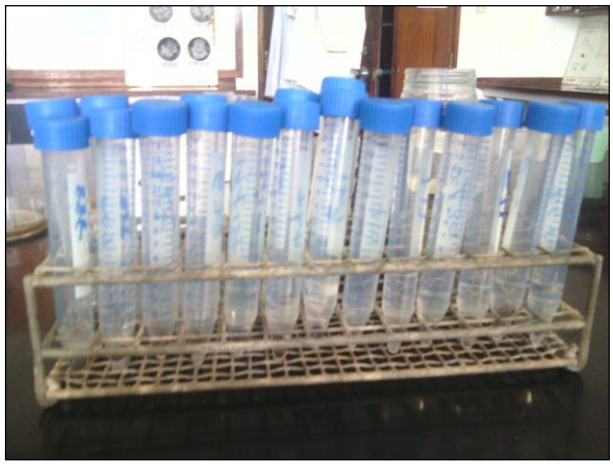


Figure 3: Tick Storage

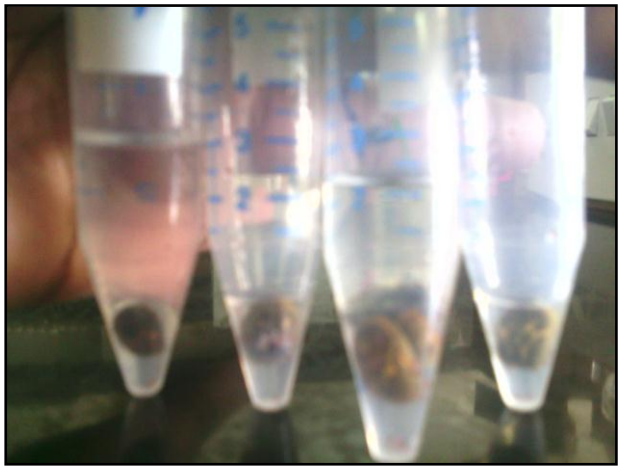
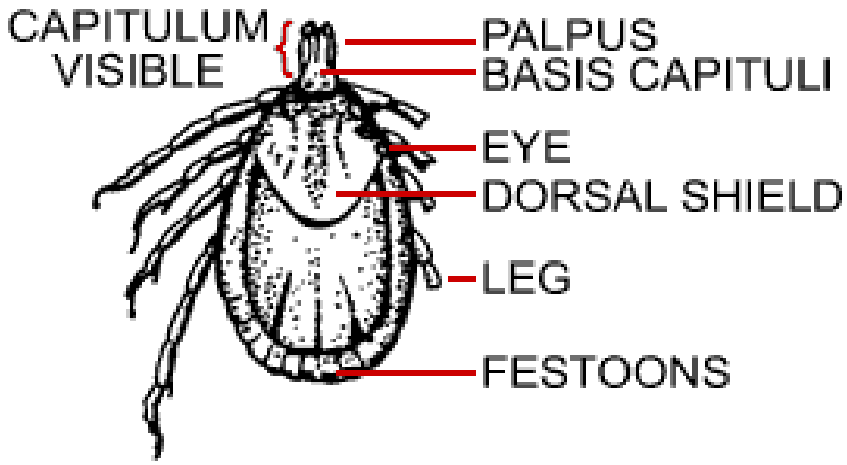


Figure 2: Tick Storage

3.5 TICK IDENTIFICATION

Once in the laboratory, ticks from each animal and from all the four collection regions were counted differently and recorded; summation of all the ticks was also done and recorded. The light micro-scope was used to determine the main morphological characteristics of each tick and speciation was done according to criteria which have been de-scribed by Walker et al.(2003). The ticks are identified by their various body parts (Figure 4), including the mouth parts, appendages, color and pattern of the scutum and absence or presence of festoons.

Figure 4: Body parts of a hard tick



CHAPTER FOUR: RESULTS

4.1 Prevalence of ticks on cattle

Out of the 20 animals examined, only one animal had no ticks. Then the overall prevalence was calculated by dividing the number of positive samples by the total sample size and multiplied by 100, yielding an overall prevalence of 95%.

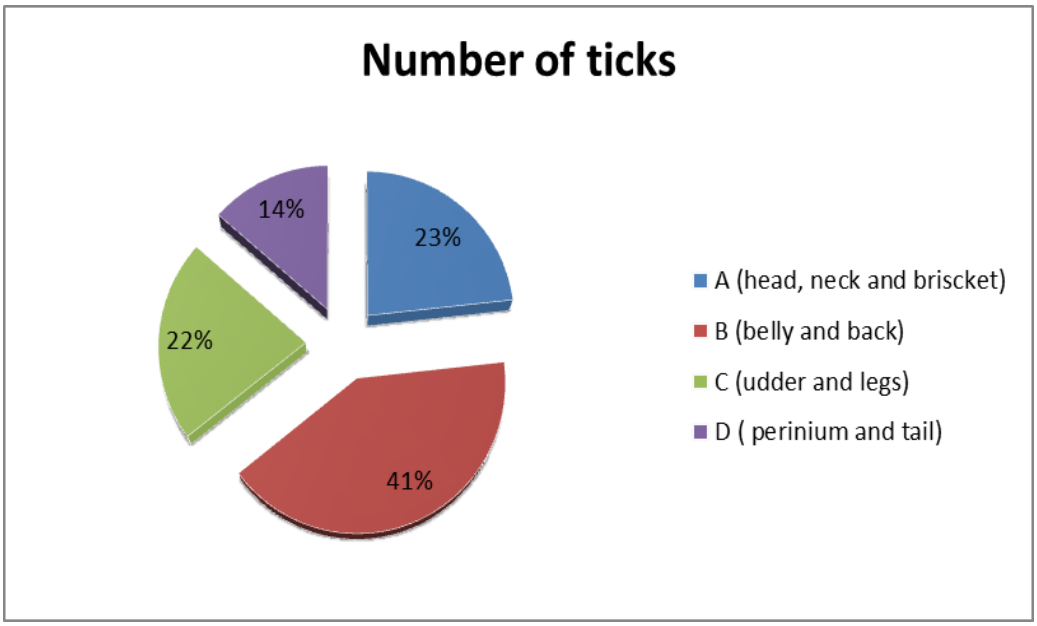
4.2 Ticks distribution.

A total of 146 ticks were collected from the 19 animals and their distribution on the various body regions of the animas is shown in Table 1. More ticks were found on region B which represent belly and back parts with a total of 60 ticks (41%), region A (head, neck and brisket parts) followed with a total of 34 ticks (23%), then region C (udder and legs) with a total of 32 ticks (22%) and finally region D (perinial and tail parts) with a total of 20 ticks (14%) (Figure 5). The distribution ratio of A:B:C:D was then calculated and found to be 2:3:2:1. Average tick population at each body region was found to be as follows: 1 in region A, 3 in region B, 1 in region C and 1 in region D as indicated in Table 1. *Boophilus decoloratus* were found to prefer region B (belly and back), out of a total of 60 ticks collected from this region 52 were *Boophilus decoloratus. Rhipicephalus appendiculatus* preferred region A (head and neck), from the study a total of 20 ticks of this species was collected and 12 were from region A.

Table 1: Distribution of ticks in various body regions of cattle on Kanyariri farm

Animal identity (ear tag no)	Number of ticks				Total
	Region A	Region B	Region C	Region D	
492	2	4	2	2	***10***
595	2	2	2	0	***6***
630	2	4	2	2	***10***
674	2	4	2	2	***10***
678	0	2	2	0	***4***
685	0	0	0	0	0
691	2	6	2	2	***12***
692	2	4	2	2	***10***
714	2	2	2	2	***8***
717	2	4	0	0	***6***
719	2	2	2	2	***8***
720	2	4	2	0	***8***
727	4	2	2	2	***10***
751	2	4	2	0	***8***
737	0	2	0	0	***2***
800	2	4	2	2	***10***
817	2	2	2	0	***6***
824	0	2	2	0	***4***
888	2	2	0	2	***6***
767	2	4	2	0	***8***
TOTAL	34	60	32	20	146
AVARAGE	***1***	***3***	***1***	***1***	***7***

Figure 5: Percentage distribution of ticks on various body regions of cattle on Kanyariri farm



4.3 Species of ticks on cattle

Two species of ticks, *Boophilus decoloratus and Rhipicephalus appendiculatus* were identified from the study cattle. Some of the ticks species are shown in Figure 6. *Boophilus decoloratus* was identified by the following characteristics: engorged ticks had a slaty-blue color and pale yellow legs, not ornate, had no festoons, eyes were present, very short compressed pedipalps and anal grooves pass behind the anus.

Rhipicephalus appendiculatus was identified by the following morphological characteristics: inornate, eyes and festoons present, hypostome and palpi are short and presence of two strong spurs on coxae 1.

Table 2 shows the species of ticks identified from each of the 19 animals examined, and their distribution in the various body regions of the animals, while Figure 7 shows the relative occurrence of the two species of ticks identified. *Boophilus decoloratus* was the most abundant

tick (86.3%) which gave a total of 126 ticks out of the 146 ticks collected. *Rhipicephalus appendiculatus* accounted for 13.7% of the ticks, with most of them found on region A (head, neck and brisket), then region B (belly and back) and none on region C and D.

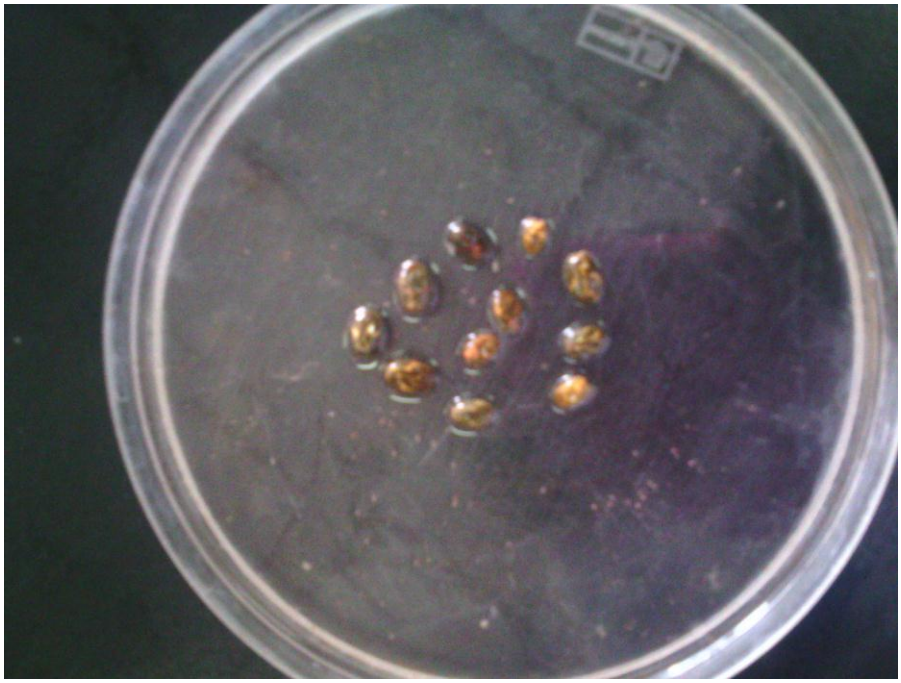


Figure 6 Ticks collected from cattle on Kanyariri farm

Animal identity (eartag no)	Species of ticks				Total
	Region A	Region B	Region C	Region D	
492	2*B.decoloratus*	2*B.decoloratus* 2*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	***8****B.decoloratus* 2*R.appendiculatus*
595	2*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	0	***4****B.decoloratus* 2*R.appendiculatus*
630	2*B.decoloratus*	4*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***10****B.decoloratus*
674	2*B.decoloratus*	4*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***10****B.decoloratus*
678	0	2*B.decoloratus*	2*B.decoloratus*	0	***4****B.decoloratus*
685	0	0	0	0	0
691	2*R.appendiculatus*	2*B.decoloratus* 4*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	***6****B.decoloratus* ***6****R.appendiculatus*
692	2*B.decoloratus*	4*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***10****B.decoloratus*
714	2*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***6****B.decoloratus* 2*R.appendiculatus*
717	2*B.decoloratus*	4*B.decoloratus*	0	0	***6****B.decoloratus*
719	2*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***8****B.decoloratus*
720	2*B.decoloratus*	4*B.decoloratus*	2*B.decoloratus*	0	***8****B.decoloratus*
727	2*B.decoloratus* 2*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	***8****B.decoloratus* ***2****R.appendiculatus*
751	2*R.appendiculatus*	4*B.decoloratus*	2*B.decoloratus*	0	***6****B.decoloratus* ***2****R.appendiculatus*
737	0	2*B.decoloratus*	0	0	***2****B.decoloratus*
800	2*B.decoloratus*	2*B.decoloratus* 2*R.appendiculatus*	2*B.decoloratus*	2*B.decoloratus*	***8****B.decoloratus* ***2****R.appendiculatus*
817	2*B.decoloratus*	2*B.decoloratus*	2*B.decoloratus*	0	***6****B.decoloratus*
824	0	2*B.decoloratus*	2*B.decoloratus*	0	***4****B.decoloratus*
888	2*B.decoloratus*	2*B.decoloratus*	0	2*B.decoloratus*	***6****B.decoloratus*
767	2*R.appendiculatus*	4*B.decoloratus*	2*B.decoloratus*	0	***6****B.decoloratus* 2*R.appendiculatus*
TOTAL	***22****B.decoloratus* ***12****R.appendiculatus*	***52****B.decoloratus* ***8****R.appendiculatus*	32*B.decoloratus*	***20****B.decoloratus*	***126****B.decoloratus* ***20****R.appendiculatus*

Table 2:Distribution of species of ticks identified in cattle in the various regions of the animals body

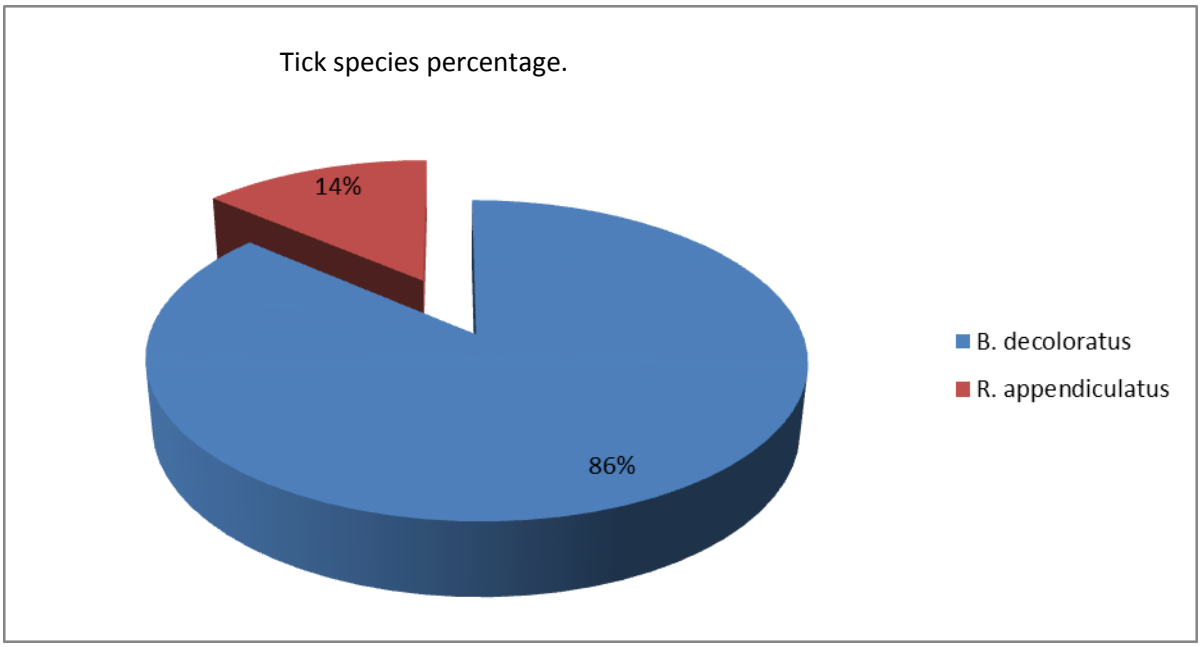


Figure 7 Percentage occurence of Boophilus and Rhipicephalus on cattle on Kanyariri farm

CHAPTER 5

5.1 DISCUSSION

In this study , a total of 146 ticks were collected from 20 dairy cows. The overall prevalence of ticks was found to be 95 %. More ticks were found on region B(belly and back) with 60 ticks out of 146 (41%),followed by region A (23%), then region C(22%) and finally region D(14%). Region B(belly and back) was dominated by *Boophilus decoloratus* species. Two species of ticks were found; *Boophilus decoloratus* and *Rhipicephalus appendiculatus,* the abundant species was *Boophilus decoloratus* with 86.3% and *Rhipicephalus appendiculatus* was the least with 13.7%. The present study done at University of Nairobi Kanyariri veterinary farm whose location is a highland agrees with the finding of Bekele (2002), that relative abundance of *B. decoloratus* increases from lowland towards highland. This tick species is abundant in wet highlands and sub highlands receiving more than 800 mm rainfall annually (Pegram et al., 1981) which agrees with the present study. (Koch, 1844): *Boophilus decoloratus* is a one host tick, also known as the blue tick, which is tough to differentiate from similar looking *B.microplus,* as the color of engorged females and dentition is the only parameter to differentiate between females. Hence, males have to be compare. It was found to be infesting cattle preferring the upper body for attachment. It is incriminated in transmission of *Babesia bigemina* and possibly *Babesia bovis*, *Anaplasma marginale* and *Borrelia theileri (*Koch, 1844*). Rhipicephalus appendiculatus* (Neumann, 1901), also known as the brown ear tick, is a three-host tick and widely distributed in Africa south of the equator. It is usually inornate, eyes and festoons present, hypostome and palpi are short,basis capituli hexagonal dorsally and coxae 1 with two strong spurs. It is parasitic on cattle, equine, sheep, goats, wild antelopes and has also been found on the dog and wild rodents (Neumann,

1901). This species occurs in a relatively warm climate and attaches most frequently in the ears which corresponds with the present study where most of this species were obtained from region A (Head and neck region) prefering the ears. This tick is the chief vector of East Coast fever of cattle caused by *Theileria parva*. It also transmits *Hepatozoon canis* and exanthematic fever of dogs, *Theileria mutans* and *Babesia bigemina* of cattle and *Rickettsia conori* and viruses of Nairobi sheep disease and louping-ill (Neumann, 1901). In none of these cases, except *Babesia bigemina*, does the infection pass through the egg of the tick (Neumann, 1901).

The overall mean tick is 7 per cow which is slightly high considering attention is given in controlling ticks in the farm, this may be due to development of resistance to acaricides by the ticks as a result of use of same type of acaricide for long period or overdilution of acaricides resulting in ineffectiveness of the acaricides.

5.2 CONCLUSION.

The species of ticks prevalent on cattle on Kanyariri farm were *B. decolaratus* and *R.appendiculatus* with *B. decolaratus* being the most abundant. *B. decolaratus* was mostly attached to the neck and body region while *R.appendiculatus* attached preferentially to the ears.

The study indicated that there was slightly high burden of ticks in the farm, despite the attention given to controlling the infestation.

5.3 RECOMMENDATIONS.

1. The acaricides to which the ticks are resistant need to be determined.

2. Tick control program, involving application of acaricides to which the ticks are sensitive should be instituted.

3. Practice integrated tick management practices involving use of acaricides and safe and economical traditional methods, such as pasture management

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