



UNIVERSITY OF NAIROBI

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES,

FACULTY OF VETERINARY MEDICINE

**PREVALENCE OF TICKBORNE DISEASES OF CATTLE IN KANYARIRI
VETERINARY FARM, KIAMBU COUNTY.**

A PROJECT REPORT

BY

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**A PROJECT REPORT SUBMITTED TO THE COLLEGE OF AGRICULTURE AND
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DECLARATION

This research project is my original work and has not been presented in any other university as far as my Knowledge is concern.

Signed.....Date.....

TOWETT K. BENARD

This project has been submitted for examination with my approval as the student supervisor.

Signed.....Date.....

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DEDICATION

I dedicate this project to my parents **Mr.** and **Mrs. Joel Koech** who spared no effort to educate me. By your unfailing support and prayers we have done this work together. May the lord bless you abundantly.

ACKNOWLEDGEMENTS

This work would not have been successful without the support and guidance of a number of people who made their contributions in various ways; First and foremost I must sincerely thank and appreciate my distinguished supervisor **DR.R.M.WARUIRU** who patiently guided me through this research process with dedication, encouragement and exemplary professional advice. I am indebted to my parents **MR** and **MRS KOECH** for offering me a generous financial support that has enabled me to complete my work. You have equipped me to serve this nation better and I am most thankful. I wish to express my sincere gratitude to **DR. CHERUIYOT**, Assistant Farm Manager – Kanyariri Veterinary Farm and **MR OTIENO**, Laboratory Technologist, Parasitology Section, who assisted me to fill the questionnaire and processed samples, respectively. Many thanks to my colleagues **WYCLIFF NGETICH** and **ENOCK LANGAT** who tirelessly assisted me to collect samples at the farm may the lord bless you both. Above all, I thank God who has granted me wonderful opportunities throughout my life.

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LIST OF ABBREVIATIONS

ECF:	East coast fever
Abs:	Antibodies
CFT:	Complement fixation test
ELISA:	Enzyme linked immunosorbent assay
PCR:	Polymerase chain reaction
IFAT:	Indirect florescent antibody test
DNA:	Dioxy ribonucleic acid
DX:	Diagnosis
RBC:	Red blood cell
KMS:	Kilometers
TBDs:	Tick borne diseases

ABSTRACT

The main objective of my project was to determine the prevalence of tick borne diseases in cattle in Kanyariri Veterinary Farm. This was achieved through retrospective studies basing on the health records from the year 2009 to 2014. Through these records, morbidity of TBDS at the farm was calculated. The study also Involved sample collection from randomly picked animals and physical examinations of these animals. Tick infestation was determined so as to try and relate the association of these ticks and the diseases they transmit. A questionnaire was designed to evaluate the efficiency of tick control program at the farm. Retrospective studies showed that 22 animals have suffered from TBDs from the year 2012-2014. The farm has not been keeping records in the past thus it was not possible to retrieve information on the health of animals from the year 2009. Anaplasmosis was the most prevalent disease followed by East coast fever and *Babesiosis* in that order. The diseases were cutting across all ages and a single case of mixed infection (ECF and BABESIOSIS) was encountered. The blood smear results showed a morbidity of 25%. In conclusion; *Anaplasmosis* was the most common disease. This was attributed to the fact that the disease is transmitted by *Boophilus* ticks which are known to be 1-host ticks thus have developed resistance. The study recommends that more research should be done so as to come up with a more effective acaricides so as to reduce economic losses due to TBDs

CHAPTER 1

1.0 INTRODUCTION

Tick borne diseases in Kenya have impacted negatively on the performance of dairy and beef Industry. This is because of high cost of veterinary services in which most farmers do not afford to ensure their animals do not succumb to such diseases. These diseases will eventually cause death thus a decline in milk and beef production. Economic losses due to morbidity and mortality of TBDS (**Perry and Young *et al* 1995**) the study focused mainly on the four major TBDS transmitted by ticks i.e., Theileriosis, Anaplasmosis, Babesiosis and Heart Water. *Anaplasma marginale* and *A. centrale* are the most important parasites in Kenya (**Ristic *et al* 1969**)

Tick borne diseases has impacted negatively on dairy production in Kanyariri Veterinary Farm.

1.1 Justification of the study

Tick borne diseases of cattle increases the production cost and lowers the income due to mortality and decline in production. East coast fever is the most important TBD of cattle in eastern, central and southern Africa (**Young *et al.*, 1988; Norval *et al.*, 1992**). University of Nairobi depend extensively on livestock production activities. Understanding the prevalence of TBDS and coming up with ways of controlling them can offer an opportunity to increase production and income hence the need of this study.

1.4 Research objectives

1.4.1 Overall objective

To determine the prevalence of TBDs at Kanyariri Veterinary Farm, Kiambu County

1.4.2 Specific objectives

- (1) Prevalence of ticks infestation and types at Kanyariri veterinary farm.
- (2) Prevalence of TBDs and their effects on cattle at Kanyariri veterinary farm
- (3) Evaluation of tick control strategies at Kanyariri veterinary farm

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Pathogenesis of East coast fever

Theileriosis is a protozoal disease caused by *Theileria parva parva* transmitted by brown ear tick, *Rhipicephalus appendiculatus*. The disease is characterized by the proliferation of lymphoblast infected with theilerial schizonts throughout the body particularly in the lymph nodes, spleen, kidneys, liver and lungs. Sporozoites produced in the acinar cells of the salivary glands of infected tick vector are inoculated along with saliva during feeding of the tick and rapidly targets the lymphocytes which become transformed after the *Theileria* schizont is formed. The infected lymphocyte is transformed into a lymphoblast and divides in conjunction with the schizont giving rise to two infected daughter cells. Within the infected lymphocytes, schizonts increase in number and undergo merogony to produce merozoites which invade the erythrocytes to become piroplasms. Piroplasm infected erythrocytes are ingested by ticks of larval or nymphal stages where they undergo a sexual cycle in the gut of the tick to produce zygotes which in turn develop into motile kinete that infect the salivary glands of the next nymph or adult (**Barnet et al. 1956**).

2.1.1 Clinical signs

Pyrexia, lymphadenopathy, severe pulmonary edema and wasting. Usually terminates with death (Fivaz *et al.*, 1989). Transmission of *Theileria parva bovis* (Boleni strain) to cattle resistant to brown ear tick.

2.1.2 Diagnosis

Lymph node aspirates-schizonts or Koch's Blue bodies (KBB) observed in lymphocytes in ECF, but in *T.annulata*, schizonts may be observed in macrophages. **Blood smears**-Observe piroplasms - pleomorphic merozoites that can be signet rings, coma or dot shaped. **Serology**-IFAT commonly used to demonstrate high antibody levels. **Molecular** -DNA probes/PCR-demonstrate parasite DNA material in sample.

2.2 Pathogenesis of Anaplasmosis

Anaplasmosis is an infectious hemoparasitic, anemic disease of cattle, sheep and goats caused by *Anaplasma marginale* and *A. centrale*. Transmission is primarily by ticks especially *Boophilus* species but mechanical transmission also do occur. *Anaplasma* species infect mature erythrocytes by endocytic process and reproduce by binary fission to produce 2 to 8 infective initial bodies which leave by exocytosis to infect other erythrocytes. Parasitized erythrocytes are phagocytized by reticuloendothelial system which release acute phase of inflammatory reactants and consequent development of fever and anemia (Connell, 1974).

2.2.1 Clinical signs

Weakness, staggering gait, ruminal stasis, constipation, depression, dehydration, dyspnoea and icterus.

2.2.2 Diagnosis

Demonstrate Anaplasma bodies using Giemsa stained smears (1-2 intracellular, basophilic inclusions located on the margins or the centre of RBC for *A. marginale* and *A. centrale*,

respectively. **Molecular** techniques (PCR/DNA probes) demonstrate genetic material of the parasite. **Serology**-high Ab titres due to the parasite infection.

2.3 Pathogenesis of Babesiosis

Babesiosis is a protozoal disease caused by *Babesia bovis* and *B. bigemina* which are intra erythrocytic parasite. They are transmitted transovarially by one host tick *Boophilus* which are distributed worldwide. *Boophilus microplus* and *B. annulatus* transmit both *B. bovis* and *B. bigemina*. Pathological effects are due to *Babesia* spp. multiplication in the host erythrocytes. After infection, multiplication of the protozoa in the peripheral vessels for *B. bigemina* and *B. bovis* result in hemolysis. Escaping parasites destroy infected erythrocytes and invade new erythrocytes. Parasite and host constituents released from destroyed erythrocytes are toxic resulting in various physiological disturbances and shock.

2.3.1 Clinical signs

Hemolytic anaemia, jaundice and hemoglobinuria (**Mahoney, 1969**).

2.3.2 Diagnosis

Smears-demonstrate parasites in infected RBC using Giemsa stained smears. Large babesias, paired merozoites of double size and small babesias maltase cross is diagnostic

Serology - IFAT, CFT or ELISA

Sub-inoculation in susceptible animals

In vitro culture-Artificial media, specific for parasite species, useful in carrier animals

Molecular-DNA probes/PCR-genetic material encoding for the parasite combinations PCR-ELISA

2.4 Pathogenesis of Heart Water

Heart water is a disease of cattle, sheep and goats caused by *Ehrlichia ruminantium* formerly *Cowdria ruminantium*. Transstadial transmission is by 3 host tick *Amblyoma* spp. Some degree of vertical transmission from cow to calf i.e., through colostrums may occur in endemic areas. *Ehrlichia ruminantium* initially reproduce in macrophages before invading and multiplying in the vascular endothelium. Signs and lesions are associated with increased vascular permeability, petechial and ecchymotic hemorrhages, hydro pericardium, hydrothorax, generalized edema and congestion.

2.4.1 Clinical signs

In per acute cases: fever, hyperesthesia, lachrimation and convulsions

In acute cases: anorexia, depression, high stepping gait, exaggerated blinking and chewing movements. Both forms terminate in prostration and convulsions. Diarrhea is occasionally seen.

In sub acute cases the signs are less dramatic and CNS involvement is inconsistent (**Cowdry (1987)**).

2.4.2 Diagnosis

[Squash preparation]

Collect brain tissue, place it in between the slides and squeeze so as to spread it. Stain with Giemsa and observe it under a microscope

2.5 Economic importance of TBDS

[a] Reduce in milk production

[b] Decreased weight gain thus attain reproductive maturity later in life

[c] Increased production cost due to the veterinary services

[d]Reduced beef production

[e]Loss of animals through death

2.6 Role of wildlife in disease transmission

As a result of wildlife/livestock interactions, *Theileriosis* has been diagnosed in cattle grazing near Game parks. African buffalo is the reservoir of *Theileria parva* species which causes disease in livestock. Cattle are dead end hosts and unable to infect intermediate host. This disease is mainly seen in pastoral communities in Maasai mara, Laikipia and Kajiado (**Kock *et. al.*, 2002**).

2.7 Control of TBDS

Methods currently used to control TBDS includes: Strategic use of acaricides,

[b]vaccination against ECF and Babesiosis

[c]Use of tick resistant breeds of cattle

[d]Treating sick animals and isolating them from the rest of the herd

[e]use of prophylactic treatment program

If tick control programs can be effective, prevalence of TBDS could be reduced leading to an increase in milk and beef production thus source of income. Attempts to control ticks using Ivermectins have shown good results. Other ways of controlling spread of TBDS is by bush clearing which will otherwise provide shelter to vectors. Disinfection of instruments used for injections or surgical operations should be done to avoid iatrogenic spread of TBDS

CHAPTER 3

3.0 MATERIALS AND METHODOLOGY

3.1 Study area

The research was carried out at Kanyariri veterinary farm. The farm is located on a 375 acre piece of land in Kanyariri village of Upper Kabete. It is 2 kms to the west of Upper Kabete campus and 15 km from Nairobi city astride the Fort Smith. The farm keeps a herd of dairy cattle, a flock of Dorper sheep, a piggery unit and layer poultry unit. It is a teaching facility in the faculties of Agriculture and Veterinary Medicine, University of Nairobi.

3.2 Study design

The research involved the use of retrospective studies basing on the farm health records from the year 2010 to 2014. Random sampling of animals was done and blood smears were made so as to demonstrate haemo parasites. The farm has got a total of 196 animals. Sampling was done among adult dairy cows, heifers and calves. A total of 20 animals were sampled i.e. 5 adults, 10 heifers and 6 calves.

Questionnaire was also administered in the farm alongside sample collection so as to evaluate tick control efficiency at the farm. The questionnaire was filled by the assistant farm manager.

Data was collected, entered on a spreadsheet, stored in a computer analyzed using Microsoft Excel and final report was written basing on the results.

3.3 Sampling choice

The farm had 196 cattle in total made up of 75 adults, 72 heifers and 39 calves. Selection was done for adults, heifers and calves whereby every 15th adult, 8th heifer and the 6th calf was isolated for sampling. At the end of selection process I was able to get 5 adults, 9 heifers and 6

calves. The animals were restrained in a crush where pricking of the ear vein was done and blood smears were made.

3.4 Preparation of blood smears

Blood smears were prepared in the field and air- dried. They were then brought to the university Laboratory for processing and microscopy for demonstration of hemoparasites. The blood smear slides were fixed in alcohol for 2minutes, stained with Giemsa for 2 minutes, excess stains washed with water, dried with plotting paper and finally mounted on the microscope and observed under oil immersion using high power magnification.

3.5 Data analysis

The health records results were recorded on a Microsoft excel and graphical presentation of TBDS incidence was made. The blood smears results were also recorded for interpretation.

CHAPTER 4

4.0 Results

The graph below represents the graphical presentation of the incidence of TBDS in the veterinary farm basing on the health records. There was a challenge of using this retrospective studies because the health records found in the farm were from the year 2012-2o14.A total of 22 animals were found to have suffered from TBDS as from the year 2012.

TIME

		2012	2013	2014
PREVALENCE	E C F	1	2	2
	ANAPLASMA	2	9	5
	BABESIA	0	1	0

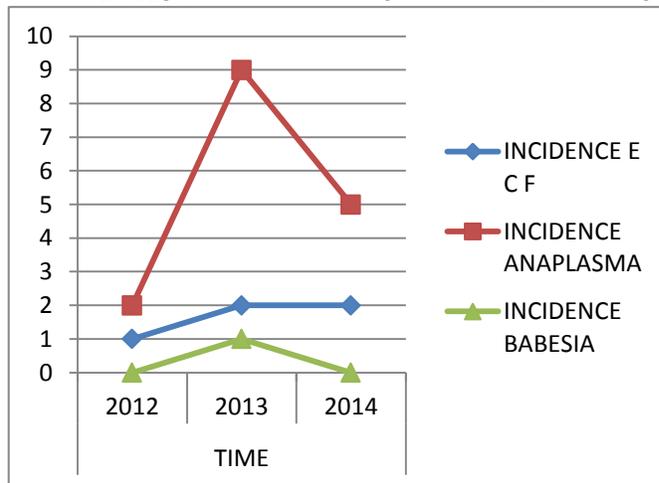


Figure 1: Graphical presentation of TBDS

The table below represents the results obtained from the blood smears obtained from the 20 animals that were sampled in the farm. All cases that were positive were anaplasmosis and the negative ones shows that the animals never had any TBDS.

Table 1: Blood smear results of different ages

CALVES		HEIFERS		ADULTS	
Tag NO.	Results	Tag NO.	Results	Tag NO	Results
898	Negative	885	Negative	790	Negative
897	Positive[Anaplas]	892	Negative	621	Positive[Anaplas]
904	Negative	886	Positive[Anaplas]	681	Positive[Anaplas]
906	Negative	852	Negative	759	Negative
907	Positive[Anaplas]	846	Negative	832	Negative
903	Negative	889	Negative		
		831	Negative		
		874	Negative		
		818	Negative		

CHAPTER 5

5.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

Anaplasmosis is the most commonly occurring TBD in the farm. The graph above shows that out of the 22 incidences of TBDS, 16 of the cases were anaplasmosis. In the year 2012 the incidence of this disease was only 2 but the number increased to 9 in the year 2013. As it will be explained later during interpretation of the questionnaire, the number declined in the year 2014 to 5 due to the measures the management put in place as far as tick control is concern.

Theileriosis become the second disease with the highest prevalence. There were no case reported in the year 2012 but in the year 2013 and 2014, 2 cases were reported yearly bringing the total number of ECF cases to 4. The reduction in number of ECF incidences can be attributed to the fact that Brown ear tick was hardly seen during sample collection but *Boophilus* was the most predominant tick in the field.

Babesiosis was only seen once in the year 2013. Despite the fact that Ehrlichiosis was mentioned in the Questionnaire to be available in the farm, records did not show any evidence on the same. Mixed infections of Theileriosis and Anaplasmosis was also seen in the year 2013 although only one (1) case was diagnosed. This then purports that however much tick control was practiced in the farm, ticks of various species can still be found in the farm because some ticks are known to develop resistance against various acaricides available in the market.

The interpretation of blood smear results is as follows; 2 adults, 1 heifer and 2 calves tested positive of Anaplasmosis. This then brings a total of 5 animals that tested positive in the 20 samples that were collected. After calculation the morbidity rate of 25% ($5/20 \times 100$). It was

worth noting that the above quoted morbidity was only for anaplasmosis because other TBDS were not observed in the samples that were collected.

Questionnaire results showed that the farm is practicing tick control were done after 2 weeks using a spray race. The farm uses Amitraz and pyrethroids and they usually change them after six months. The common ticks in the farm are *Boophilus* and *Rhipicephalus* spp. The common tick borne diseases are Anaplasmosis, Babesiosis, ECF and Ehrlichiosis. The methods of production system in the farm are the free range method where the animals graze on pastures.

5.2 Conclusions

From the study, the following conclusions can be drawn;

- The most predominant tick borne disease in the veterinary farm was anaplasmosis
- This was attributed to the fact that the most common ticks found in the animals were *Boophilus* species
- These one-host ticks are known to develop resistance to the common acaricides available in the market.

5.3 Recommendations

Basing on the results, the following recommendations were made;

More research should be done to come up with various acaricides which are more effective to the ticks that have developed resistance.

Increasing the frequency of acaricide application on the animals will help reduce the prevalence of tick borne diseases.

APPENDICES

Appendix 1: Questionnaire

This questionnaire is aimed to gather brief information that can assist to determine the prevalence of tick borne diseases in Kanyariri veterinary farm. The data obtained will be used together with data from health records and the results of blood smear samples.

Name.....Address.....

[1] Do you apply acaricides on your animals? [YES] or [NO]

If yes, how frequent do you it?

[2] Which methods do you use to apply acaricides?

[a] Hand spraying [b] spray race [c] Dip wash

[3] Why do you prefer the above mentioned method?

[4] Which acaricides do you normally use?

[5] How long do you take to change the acaricides you are using?

[6] In your opinion do you think tick control method is efficient? [YES] or [No]

If yes, give reason.....

[7] Which ticks do you think are the most common in your farm?

[a] *Boophilus* spp. [b] *Rhipicephalus* spp. [c] *Amblyoma* spp. [d] *Dermacentor* spp.

[8] Do you think the most common ticks have developed resistance to acaricides? [YES] or [NO]

If yes, have you ever done acaricide resistance test? [YES] or [NO]

If yes, what were the results?

[9] Do you encounter tick borne diseases in your farm? [YES] or [NO]

If yes, which ones [a] Anaplasmosis [b] Babesiosis [c] East Coast fever [d] Heart

Water

Others? Specify.....

[10] How often do your cattle succumb to tick borne diseases?

[11] How do you diagnose the above mentioned diseases?

[a] Based on clinical signs [b] Sample taking

Why do you prefer the above choice?

[12] What are the methods of production system in your farm?

[a] Confined [b] Zero grazed [c] Free ranged

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