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Research

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Prevalence and Identification of Bovine Ixodid Ticks in Horo Guduru Animal Breeding and Research Center, Horo Guduru Wollega Zone, Western Ethiopia

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ABSTRACT

Background and Aim: Even though Ethiopia encounters considerable losses due to tick infestations, and existing research has reported the distribution and abundance of tick species across different parts of the country, there are no evidences supporting the prevalence and distribution of hard ticks at the Horo Guduru Animal Breeding and Research Center. Therefore, the main objectives of this research are: to analyze the prevalence of ixodid ticks and identify them in the study area as well as to provide baseline data on the relative distribution of tick species.
Materials and Methods: A cross-sectional study was conducted on 409 cattle (305 local breed (Horo breed) and 104 cross breed (Horo breed × Jersey breed) using simple random sampling techniques for identification and determination of prevalence of ticks at the study area.
Results: In the present study, the overall prevalence of tick infestation was recorded as 78.23%. Two tick genera were identified with the composition of Ambylomma (51.2%) and *Rhipicephalus (*48.8%). In the study area, four tick species were identified with their respective prevalence of *Rh. (B.) decoloratus* (33.8%), *A. variegatum* (21.3%), *Rh. e. evertsi* (15%) and *A. cohaerens* (29.9%). The prevalence of tick infestation was found to be significantly different ($p<0.05$) between breeds with higher prevalence in local breed (Horo breed) (83.6%) than cross (Horo breed × Jersey) (62.5%). The prevalence of tick infestation among age groups was highly prevalent in adult cattles (79.08%) relative to young (73.3%) cattles. The prevalence of ticks was also highest in medium (81.4%) and lowest in good (73.4%) cattles respectively.
Conclusion: The overall prevalence rate of ixodid ticks in the current study area was 78.23%. According to the present finding, the most important tick species that was intensively investigated were *A. decolaratus, Rh. evertsi-evertsi, A. varigatum,* and *A. cohaerence*. The study indicated that there was a high burden of ticks in the discussed area.

KEY WORDS: Cattle; Horro guduru; Prevalence; Tick.

INTRODUCTION

Ethiopia constitutes the largest livestock and draft animal population in the African continent which reaches a count of approximately 56,706,389 cattles, 29,332,382 sheep, 29,112,963 goats, 2,033,115 horses, 400,329 mules, 7,428 donkeys, 1,164,106 camels, and 56,866,719 chickens in the country.[1] Despite the large population of animals, productivity in Ethiopia is low, and often below the average for most eastern and sub-Saharan African countries, on account of prevailing animal disease (bacterial, viral, protozoan agents of infection), poor nutritional status, ectoparasitic activity, reproductive insufficiency and effective management of existing constraints.[2]

Vector and vector-borne diseases pose major constraints towards the development of viable livestock industries.[3] Among these, the incidence of tick and tick-borne diseases (TBD)

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are widely prevalent throughout the world, particularly in tropical and subtropical countries, which is of tremendous economic importance in livestock production.[4] It has been estimated that 80 percent of the world's cattle population is exposed to tick infestations.[5] The annual economic losses caused due to ticks and tick-borne diseases in cattle alone, are estimated as 13.9 to 18.7 billion United States Dollar (USD) worldwide.[6]

The problem is persistent and severe in developing countries where the available resources for the control and eradication of ticks and TBD are restricted.[5] In most parts of Africa, including Ethiopia, tick and TBD such as babesiosis, cowdriosis and anaplasmosis has economic significance. In Ethiopia, ticks are external parasites or ectoparasites that are considered responsible for maximum economic loss due to livestock infestations, particularly affecting cattles.[7]

In Ethiopia, several species of ticks belonging to the genus Amblyomma, Boophilus, Rhipicephalus, Hyalomma, and Haemaphysalis have been reported. Existing records are suggestive of considerable losses to the livestock and the economy of Ethiopia, ranking it third among the major parasitic diseases prevalent in the country. The environmental condition and vegetation of Ethiopia was considered as highly conducive for the vectors, and the associated diseases they cause.[8]

Besides disease transmission, ticks inflict heavy economic losses. Tick infestations are severe in different parts of Ethiopia and at a conservative estimate, one million United State Dollar is lost annually to the rejection of downgraded hides and skin, on account of the damage caused by ticks. It is estimated that an annual loss of 5,000,000 USD is incurred due to the downgrading of hide and skin having been affected by ticks, and approximately 65.5% of the major defects associated with hides in eastern Ethiopia were due to ticks.[9,10] Even though Ethiopia encounters considerable losses due to tick infestations, and existing research has reported the distribution and abundance of tick species across different parts of the country, there are no evidences supporting the prevalence and distribution of hard ticks at the Horo Guduru Animal Breeding and Research Center. Therefore, the main objectives of this research were:

- To analyze the prevalence of ixodid ticks and identify them in the study area.
- To provide baseline data on the relative distribution of tick species.

MATERIALS AND METHODS

Study Area

The study was conducted at Horo Guduru Animal Breeding and Research Centre, Guduru District, Horo Guduru Wollega zone, Oromia Regional State, Western Ethiopia from November, 2015 to March 2016, Gregorian calendar. The area under study was located at a distance of about 275 km west of Addis Ababa along Gedo-Finchaa Sugar Factory highway. It was situated at an altitude of 2,296 meters above the sea level, represented by 9º9'N latitude and 37º26'E longitude. The minimum and maximum temperature of the area was recorded as 20 ºC and 30 ºC respectively. This region received an annual rainfall ranging from 1000-2400 mm, according to the annual reports of Guduru District. Guduru district on account of its climatic conditions and location, was considered suitable for the maintenance of livestock. Horo Guduru Animal Breeding and Research Centre held a total of 1800 heads of cattle. The predominant types of the cattle observed were the Horo breed and the Horo Jersey crossbreed. Cattle production plays an important role as a primary source of revenue and supports the distribution of improved heifers at a close vicinity of the farmers. The center where the present study was undertaken was supervised by the management of Wollega University for research, providing an additional source of income to the University.

Study Population

The study population included 409 cattles selected from the Horo breed and the crossbreeds of Horo and Jersey breed that were maintained under semi-intensive production system, which varied with age, sex, breed, and physical condition.

Study Design

A cross-sectional type of study was conducted from November, 2015 to March, 2016 in Horo Guduru Animal Breeding and Research Center, Oromia Regional State, Western Ethiopia to identify and determine the prevalence of hard ticks in selected cattles of Horo Guduru Animal Breeding and Research Center.

Sampling and Sample Size Determination

The sample size was selected by using the simple random sampling from the study population. The total number of cattles required for the study was calculated based on the formula provided.[11] Since there was no study conducted before on the study area, 50% expected prevalence was taken and 5% desired level of precision, a 95% confidence level and a *p*-value less than 0.05 was considered as statistically significant.

$$n = \frac{1.96^2 P_{exp} (1- P_{exp})}{d^2}$$

Where, n= sample size required

1.96=the value of Z at 95% confidence interval

P_{exp}= expected prevalence

d= desired absolute precision

Hence, the required sample size was 384 cattle

$$= \frac{1.96^2 \times 0.5(1-0.5)}{(0.05)^2} = 384 \text{ cattle}$$

But to increase the precision of the study, 409 cattle were

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included in the study.

Study Methodology

Ticks were collected from the half body regions of selected cattle and these ticks were examined to their species level. The total tick burden was also determined by performing tick counting.

Tick Collection and Preservation

The ticks were separated from the body of the cattle, after being restrained in swarms, and by careful physical handling. The skin of each animal was inspected for the presence of ticks following which they were manually collected using forceps from the different regions of the body of each cattle breed. The adult ticks (both sexes) that were collected in universal bottles, were preserved in 70% ethyl alcohol, and then transported to the Bedele Regional Veterinary Laboratory.[12]

Processing of the Sample and Identification

First, a gross identification of the ticks were performed following which they were classified into different genera . The species of the ticks were identified by analyzing the sample spread out on a petridish. As a final step, the ticks were classified into different species depending on their morphology, and basic structural characteristics such as shape of the scutum, leg color, body and its ventral structure.[12]

Data Management and Analysis

The data collected from the field was recorded in a Microsoft excel spread sheet. Then, the data was coded and analyzed using the statistical package for social science (SPSS) software version 20. For different variables, frequency, a 95% confidence interval, and a *p*-value of 5% were used to compute the degree of association between the dependent and independent factors. The data maintained in the MS excel spreadsheet was analyzed, and descriptive statistics was employed to determine the tick infestations due to host risk factors such as age, sex, breed, and body condition score). During the data analyses, the confidence level was maintained at 95% and $p<0.05$ was set as the level of significance.

RESULTS

Prevalence and Distribution of Ticks

A total of 1,152 adult Ixodidae ticks were collected from the half body region of 409 cattles that were sampled and tested positive for tick infestations. In general, two Ixodidae tick genera and four species were identified from the study area. From the identified genera, Ambylomma (51.2%) was the most abundant and widely distributed genus, followed by the genus Rhipicephalus *(*48.8%), as has been summarized in Table 1.

Distribution of Tick Species

Rhipicephalus (B.) decoloratus was the most abundant tick species among those identified and represented 33.8% (389/1152) of the total ticks collected followed by 29.9% (345/1152) belonging to the genus, *Ambylomma cohaerence*. However, *Rhipicephalus e. evertsi* constituting only 15% (173/1152) of the collected tick was considered as the least abundant tick species. The male to female sex ratio for tick species in the results indicated a higher number of males for most tick species except in the case of *Rhipicephalus e. evertsi,* which showed a higher ratio of female tick species (male to female ratio were 1.44:1). Sex determination was performed on the total tick population being studied. As was observed, 618 were males while the remaining 534 were female, with an overall female to male ratio of 0.86:1. The scrotum and udder, under tail, axial, groin and belly, neck region, dewlap and neck, vulva, and peri anal and ear region, were the sites from which most of the ticks were collected (Table 2).

In this study, the prevalence of tick infestation in localbreeds was recorded as 83.6% (n=305), and 62.5 (n=104) in cross breeds. The body condition score of the cattle population was considered as variable with respect to the tick infestation rate. Accordingly, the prevalence of ticks in most medium body condition cattle was more relative to cattle having good or poor body conditions. On the other hand, the difference in the prevalence of ticks in different age groups of cattle indicates a greater prevalence of ticks in most of the adult animals relative to the young calves (Table 3).

DISCUSSION

The distribution, abundance and identification of tick species infesting cattles in Ethiopia vary largely from one area to another. In the present study, the overall prevalence of tick infestations at the Horo Guduru Animal breeding and Research centre was 78.23%. This finding was slightly higher than that estimated from the study conducted at Fiche Selale by Tadesse and Sultan[13] which was recorded at 59.4%, and in the works of Tikit and Addis[14] who had conducted the study at Holeta, central Ethiopia, and reported a value of 25.6%. The most abundant tick species

Table 1: Distribution of Tick Genera in Study Area.

Genus	Percentage of total ticks
Ambylomma	51.2% (590/1152)
Rhipicephalus	48.8% (562 /1152)
Total	**100**

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Table 2: Distribution of Cattle Tick Species in the Study Area.

Tick species	Total Count	Sex		F: M	Prevalence (%)	X^2	*p*-value
		M	F				
Rh(B).decoloratus	389	222	167	0.752:1	33.8	78.499	0.000
A. cohaerence	345	185	160	0.86:1	29.9	73.094	0.000
A.variegatum	245	140	105	0.75:1	21.3	39.290	0.000
R.e.evertsi	173	71	102	1.44:1	15	23.895	0.000
Total	**1152**	**618**	**534**	**0.86:1**	**100**		

(Note: x^2=chi-square; *Rh.(B.) decoloratus=Rhipicephalus (Boophillus) decoloratus; A. coherence= Ambylomma cohaerence; A. variegatum=Ambylomma variegatum*; *R. e. evertsi=Rhipicephalus evertsi evertsi.*

Table 3: Prevalence of Ixodid Ticks with Respect to Risk Factors.

Risk factors	Category	Number of examined	Positive result	Negative result	revalence %	*p*-value (x2)
Sex	Male	137	107	30	78.1	0.962 (0.02)
	Female	272	213	59	78.3	
Age	Young	60	44	16	73.3	0.79 (0.994)
	Adult	349	276	73	79.08	
Breed	Local	305	255	50	83.5	0.00 (20.293)
	Cross	104	65	39	62.5	
Body condition	Good	162	119	43	73.4	0.165 (3.64)
	Medium	113	92	21	81.4	
	Poor	134	109	25	81.4	

Note: x^2=chi-square

observed in the study area was *Rh.(B.). decoloratus* constituting nearly 33.8% (389/1152) of the tick population being examined. This observation was in line with the results of the study conducted by Tamiru[15] in Assela. The Teshome et al[16] reported the highest prevalence of *Rh(B). decolaratus* (80%) in the study area. A prevalence rate of 30.63% was indicated by Pawulos and Derese[17] on the basis of a study conducted at the Humbo district in SNNP. However, this result was not consistent with the findings of Alekaw[18] for the study conducted at Metekel Ranch, Ethiopia indicating a prevalence rate of 5.7%.

In this study, *Ambylomma coherence* was observed as the second most abundant tick species (29.9%) in the study area. This finding was in agreement with the tick survey conducted in western Ethiopia, in which *A. cohaerence* was considered as the most prevalent tick species in MezanTeferi with a corresponding prevalence rate of 50.5%.[19] This observation may have been due to the persistence of humidity throughout the year in western Ethiopia.

Amblyomma variegatum was the third most abundant tick species to have been collected and represented 21.3% of the total count. The observed prevalence rate for this species was relatively lesser than the results due to various previous studies reported by different authors: 75.91% by Mesele[20] in Bahir Dar, 45.49% by Belew and Mekonnen[21] in Holeta and 38.87%), ,and by Kassa and Yalew[22] in Haramaya district, respectively.

R. e. evertsi was the fourth most abundant ticks' species constituting nearly 15 % of the sample in the present study. This tick species was considered as prevalent by different authors, an observation which was in line with the results of the present study results as the findings of Bahir Dar[23], Awasa.[24,25] *R. evertsi evertsi* has a short mouth part h to feed on soft areas.

The female to male ratio of ticks in this study was determined. As observed , there were a greater number of males for most species except *Rhipicephalus. e. evertsi,* which showed a higher ratio of female tick species (male to female ratio were 1.44:1). This record was in agreement with the previous studies of Keirans and Robbins, Fanos et al[26,27] in a majority of tick species with the exception of *R. e. evertsi*, in which the male ticks outnumber the females. This observation may be closely related to the fact that female ticks will be engorged and dropped off to the ground to lay eggs, while males tend to remain dependent on the host for several months to continue feeding and moulting.[28]

In this study, different animal related risk factors were studied to determine whether there was a significant variation in the tick infestation between and among different groups of animals with suspected risk factors. In this study, the prevalence of tick infestations in local breeds (83.6%) was significantly higher than that in the crossbreeds (62.5%). The findings of our study was concomitant to the other findings in which there was a proven record of a prevalence rate of 58.18% in the local breed cattle and 10.55% in the cross breed in Haramaya district of east Ethiopia, as was indicated by Kassa and Yalew[22] this differences in tick infestation may have been attributed to the lack and or

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decrement in supplementary feed provided to the local cattle breeds.

The proportion of tick infestation was higher in adult animals as compared to young animals. However, there was no statistically significant association (p>0.05), and the greater prevalence rate may have been due to outdoor management, and movement of adult animals over long distances in the search of food and water in comparison to the younger animals, maximizing the chance of exposure to ticks. This observation was also in agreement with the findings,[21,29,30] who stated a similar observation for a higher proportion of adult cattle being studied.

The difference in the prevalence rate was found to be statistically insignificant between the two sexes of the cattle population. This result was also in accordance to the studies undertaken by the other authors in Benchi Maji,[31] but it was not in agreement with the findings of Bossena and Abdu[32] in Assossa. In the study area, the female cattle were greater in number than the males, but the females were less exposed to ticks in comparison to males, having been kept around the farm due to dairy requirements.

The proportion of tick infestation was slightly lower in good body conditioned (73.4%) relative to the poor body conditioned (81.3%) and the medium body conditioned animals (81.4%). This observation could be attributed to the fact that good body scored animals showed good resistance, while the poor body conditioned animals were susceptible to the ticks. The well-fed animals were highly resistant to different types of diseases to which they were exposed when they grazed in the field or were maintained in their sheds.

CONCLUSION AND RECOMMENDATIONS

The overall prevalence rate of ixodid ticks in the current study area was 78.2%. Relevant information on the prevalence and distribution of tick species was very essential to assess the economic loss incurred due to tick infestations, and also to implement effective tick control. Among ectoparasites, ticks have caused the greatest economic loss to the livestock population either by transmitting a wide variety of tick-borne diseases (TBD) or by affecting the health of animals besides aggravating the quality of their hides and skin. The important tick species that was abundantly investigated in the study area includes: *A. decolaratus, Rh. e. evertsi, A. varigatum,* and *A. cohaerence*. The study indicated that there was a high burden of ticks in the discussed area. However, the attention given to controlling the infestation was not sufficiently available. The main control methods necessary for tick and tick born diseases, included the selection of tick-resistant cattles, use of acaricides, effective livestock management, evaluation and implementation of traditional practices or remedies that appear to be valuable for effective tick control. In general, there is no fixed distribution of ticks but can be determined following a complex interaction of factors such as climate, host density, host susceptibility, grazing habits, and pasture-herd management. Based on the conclusion of this study, the following recommendations were reached:

- Effective tick control and prevention programs should be formulated and implemented on the basis of the epidemiological distribution of ticks and the associated risk factors.
- More attention should be given to the selection of resistant cattle breeds.
- Better and appropriate pasture management should be implemented in grazing areas.
- There should be seasonal pastures available and help provide cattle treatment before and after the rainy season.

COMPETING INTEREST

The authors declare that the manuscript has no competing interests.

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The authors declare that all procedures were performed with the approval of Horo Guduru Animal Breeding and Research Center, Horo Guduru Wollega Zone Animal Ethics Committee.

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