Prevalence and Distribution of Bovine Ticks in and Around Asella Town, Arsi Zone, Oromia, Ethiopia

[1]Mamiya Horato, [1]Tinsae Kebede and [2]Abdullah Beka

[1]Shalla District Livestock and Fishery Resource Development Office,
Aje, West Arsi Zone, Oromia, Ethiopia
[2]West Arsi Zone Livestock and Fishery Resource Development Office,
Shashemene, Oromia, Ethiopia

Abstract: A cross-sectional study was conducted from November 2015 to April 2016 in and around Asella town for determining the prevalence of ixodid ticks and assessing the difference in infestation among the different risk factors such as breed, age, sex and body condition. Cattle from different localities found in Asella district were selected by systematic random sampling technique and then examined for tick infestation. A total of 384 local and crossbred cattle which were kept under extensive management system were examined. Of which 274 (71%) were infested by one or more ticks. The relative prevalence of each species was *Amblyomma variegatum* (39.5%), *Rhipicephalus (Boophilus) decoloratus* (15.4%), *Amblyomma coherence* 41 (10.7%), *Rhipicephalus evertsi evertsi* (4.2%) and *H. rufipse* (1.6%). *A. variegatum* showed higher preference to axial, scrotum/udder, groin and belly and *R. decoloratus* species was found prominently on the back and neck as well as *R. evertsi evertsi* showed a high preference to the under tail and perianal and vulva regions of the body. Statistical analysis showed significant difference (χ^2=141.068, p<0.05) in the prevalence of tick infestation among age groups with higher prevalence in cattle with age 1-4 years (73.8%) than both 5-8 years (69.8%) and <8year (71.8%). Furthermore, statistically significant difference (χ^2=63.066, *p*<0.05) in tick infestation was found among cattle breeds having different body conditions with a highest prevalence scored in poor (77.9%) followed by good (68.7%). The prevalence of tick infestation was found significantly higher (p<0.05) in local breed cattle (72%) than cross breed ones (52.8%), but no statistically significant association was observed among sex groups (p>0.05). The high prevalence of tick infestation in the study area might be associated to lack of community awareness about the impact of ticks, health care services and management practices of cattle. It is strongly suggested that the need to implement community awareness together with the setting up of tick prevention and control strategies.

Key words: *Amblyomma* · *Rhipicephalus* · Ixodidae · Tail

INTRODUCTION

Livestock plays a vital role both in national economy and in the livelihood of rural communities in the sub-Saharan African countries [1]. Livestock provides drought power, milk and meat, input for crop production to improve soil fertility and are used as raw materials for industry. Various estimates show that the livestock sector contributes 13-16 % of the total agricultural GDP of the countries [2].

In Ethiopia, livestock plays an important role in providing export commodities, such as meat, live animals, hides and skins to earn foreign exchange to the country. In crop-livestock farming system in the highlands parts of the country, livestock mainly used for drought power, milk production and as source of manure [3]. Skins and hides are also important components of the livestock sector in generating foreign export earnings. Apart from these, they also serve as a means of risk diversion and accumulation of wealth among the rural community [4].

Corresponding Author: Tinsae Kebede, Shalla District Livestock and Fishery Resource Development Office,
Aje, West Arsi Zone, Oromia, Ethiopia.

The dominant economic feature of the country is the agriculture sector of which livestock is a very important and essential component [5]. This indicates a huge potential of the country in the sector. In the highland areas of the country, livestock are raised together with crop cultivation for their livelihood whereas; in the lowland or the pastoralists subsistence is based mainly on livestock and livestock products [6]. Livestock production is an important sector of Ethiopian agricultural economy, providing a significant contribution to gross domestic and export products and raw materials for industries [7].

Cattle play a significant role in the socio-economic life of the people of Ethiopia. In addition to their products like meat and milk; cattle provide draught power for cultivation of the agricultural lands of many peasants in the country [8]. Despite the huge number of cattle in Ethiopia, their economic importance and productivity is low due to the constraints of different cattle diseases, poor nutrition and management, lack of marketing facilities and opportunity, inadequate animal health services, uncoordinated development programs between various levels of government institutions and/or non - government organizations and poor performance of indigenous breeds. These constraints result in poor reproductive performance of dairy cattle. Consequently, the average national milk production remains among the lowest in the world even below African standard [9]. However, there is a slow and gradual overall growth in milk production in Ethiopia due to cross breeding programs that are being introduced to increase milk production [8, 9].

Diseases have numerous negative impacts on productivity and fertility of herds due to mortality and morbidity, loss of weight, depressed growth, poor fertility performance [10]. Among various diseases of cattle, external parasites have a negative impact on the performance of the cattle. Although more than 889 species of tick in the world are important to man and domestic animals, these many species must be controlled if livestock production is to meet world needs for animal protein [11]. Tick bite can be directly debilitating to domestic animals causing mechanical damage, irritation, inflammation and hypersensitivity and when present in large numbers, feeding on animals may cause anemia and reduced productivity. The salivary secretions of some tick species may cause toxicosis and paralysis, however, more importantly; when they attach and feed they are capable of transmitting a number of pathogenic viral, bacterial, rickettsial and protozoal diseases to livestock. Ticks are important vectors for diseases like theilerosis,

anaplasmosis, babesiosis and rickettsiosis (heart water) in domestic animals; they also cause non specific symptoms like anemia, dermatitis, toxicosis and paralysis in animals. Hence ticks are one of the most significant groups of arthropod pests of veterinary medicine practice [12].

Ticks are obligate blood feeding ectoparasites of vertebrates particularly mammals, birds and reptiles throughout the world. Approximately, 889 species of ticks have been described worldwide and there are two well established families of ticks, the *Ixodidae* (hard tick) and the *Argasidae* (soft ticks). Both are important vectors for disease causing agents to humans and animals throughout the world [13]. Over 79 different species of ticks are found in eastern Africa, but many of these appear to be of little or no economic importance. In Ethiopia, about 47 species of ticks are found on livestock and most of them have important as vectors and disease causing agents and also have damaging effect on skin and hide production [14, 15].

Although there are many studies which showed that tick infestation of cattle is prevalent in Arsi Zone of Oromia Regional State, identification of the major species ticks has been found a subject of vast amount of research. Despite this attention, identification of the major species of ticks in the area is still very crucial in the region.

Therefore, the present study was conducted with the following main objectives:

- To assess the prevalence of tick infestation of cattle in the study area.
- To identify the major species of tick and their predilection sites of cattle in the study area.
- To determine the association of different risk factors with occurrence of tick infestation in cattle.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted in and around Asella town which is a capital town of East Arsi Administration Zone of Oromia National Regional State. Asella town is located about 175 km South East of Addis Ababa. The area comprises mid land area and high land area with altitudes of 1800-2500 and high land area with altitude of 2500-4130 meters above the sea level. The annual mean rainfall of the area ranges from 2000 up to 4000 mm and annual ambient temperature varies from 20°C to 30°C. The livestock populations of the area comprise about 82190 cattle, 51292 sheep, 11479 goats, 22055 equines and 162015 poultry [16].

Study Population: The study population was cattle found in Asella town and in nine rural kebeles of Asella district. Cattle of local and cross breeds with different age, sex and body condition scores managed under extensive management system were the target animals in this study.

Study Design: A cross sectional study was conducted from November 2018 to April 2019. Cross sectional clinical study was used to determine the prevalence of tick infestation of cattle in randomly selected animals. Appropriate samples were collected from animals and specimens were preserved and transported to Asella Regional Veterinary Laboratory for identification of the species of ticks. The total of 384 (three hundred and eighty four) local and cross breeds of cattle which were not treated with any of acaricides for all the months during the time of our study were examined. Out of the total 384 animals examined, 53 cattle were cross breed and the rest of 331 animals were local breed. Risk factors like breed, age, sex and body condition scores were considered in the study.

Sample Size Determination: The sample sized required for this study was determined depending on the expected prevalence of the parasite and the desired absolute precision. The sample size was computed using the formula given in Thrusfield [17] as follows.

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

where: n = required sample size; Pexp = expected prevalence; d = desired absolute precision.

There are many studies which indicate the prevalence of tick infestation in the study area with average prevalence of 68%. Therefore, an expected prevalence of 68% was used to estimate the sample size. Using desired 95% confidence interval, 5% precision and 68% expected prevalence, the necessary numbers of cattle needed to determine the prevalence tick infestation in cattle and to identify the major tick species were 314 cattle. However, 384 more cattle were included for increasing the precision of the study.

Sampling Methods: Simple random sampling and systematic random sampling were used in this study. Simple random sampling technique was used to select the study kebeles found in and around Asella town and to select study animals from selected households. Systematic random sampling was used to select the owners of animals in selected kebeles.

Study Methodology: A total of 384 cattle managed under extensive management system were included in the present study. Out of the total of 384 cattle, 331 and 53 were local breed and cross breeds, respectively. The age of animals were determined by their dentition and cattle with the age of less than 1 years were considered as young; cattle with the age of 1-3 years were considered as adult and cattle with the age of above 3 years were considered as old [18]. Other parameters like body condition of animals were determined by using accepted techniques. Finally, the presence tick was detected by general inspection of the body of cattle (head, neck, flanks, fronts, hind legs, scrotums and under tail etc.). From clinically positive animals, ticks were collected for identification.

Sample Collection: Sample collection was carried out in all selected animals which were not treated with any of acaricides within a month since the beginning of the current study. Examination of each animal was conducted by visual inspection of the whole body of cattle for the presence of even a single tick on the body of an animal. Once after the selected animals were restrained, some visible ticks were collected from body on alternative side in cattle. Ticks were collected using alcohol by dipping the ticks and the surrounding skin to remove embedded living ticks. Care was taken to ensure that the mouth parts would not left behind during the traction with thumb forceps. Finally, ticks were collected in 70% of ethyl alcohol in vials for preservation until subsequent examination for their identification was carried out, as described by Walker *et al.* [19]. All samples were clearly labeled with the date of sampling, the type of sample, breed type, age, sex, body condition and the Kebele where the samples were collected.

Identification of Ticks: Ticks collected from selected animals were properly transported using universal bottles in 70 % of ethyl alcohol to Asella Regional Veterinary Laboratory. Then in the laboratory, they were identified up to genera level grossly and species levels by their morphological features using stereomicroscopy. Ticks were identified into their species level depending on their morphology and identification structures they had, such as shape of scutum, leg color, body, coxae one and ventral plates. During tick identification up to species level in the laboratory, the sample ticks were placed in Petri dishes and were examined under stereomicroscope. Additionally, reference materials like props, identification key and color print pictures of different tick species were used [18, 19].

Data Management and Analysis: The data were entered and managed in Microsoft Excel 2007 computer program. All the data analysis was done by Statistical Package for Social Sciences (SPSS) software version 16. Descriptive statics such as percentages and frequency distribution were used to describe the nature and the characteristics of the data. The prevalence of tick infestation and the major tick species identified in the area were analyzed using percentages. The association of different risk factors with the prevalence of tick infestation was computed by Chi-square (χ^2) test. In all analysis, comparisons having p-values less than 0.05 (p<0.05) were considered as statistically significant.

RESULTS

Prevalence of Tick Infestation: Out of 384 cattle of which 331 local breed and 53 cross breeds sampled 71.34% (274/384) of the animals were found to be infested with one or more species of ticks. The overall prevalence of tick infestation of cattle was found 71.34% and was different in different breeds of cattle. It was 74.00% (246/331) and 52.80% (28/53) in local breed and cross breeds of cattle, respectively as shown on Table 1.

Identification of Ticks and Their Predilection Sites: Tick genera of *Amblyoma, Rhipicephalus* and *Hyalomma* were the different genera of ticks those were identified in the area in the study period. The species of ticks those were identified under the four genera were *A. variegatum, R. decoloratus, Amblyomma coherence, Rhipicephalus evertsi evertsi* and *Hyalomma rufips*. From the total of infested 274 cattle, 152 (39.50%), 59 (15.40%), 41 (10.70%), 16 (4.20%) and 6 (1.60%) were found to be infested by *Amblyomma variegatum, R. decoloratus, A. coherence, R. evertsi evertsi and H. rufips,* respectively. From the five

species of ticks identified, *A. variegatum* and *H. rufips* were found to be the dominant tick species and least tick species identified with infestation rate of 39.50% and 1.60%, respectively (Table 2).

The major predilection sites of the five identified species of ticks on the animals were also assessed and it was found that each species of ticks preferred different sites on the body of cattle. The most favorable predilection site for *A. variegatum* and *H. rufipes* were found to be the ventral part of animals (udder/scrotum, axial and groin). However, *R. decoloratus* was mostly found on dewlap, head and back; and on the rest of body parts of infested cattle. *R. evertsi evertsi* was found most often under tail, vulva area and perennial region of infected cattle.

Association of the Prevalence of Tick with Different Risk Factors: The association of the prevalence of tick infestation with different risk factors was assessed in this study. It was found that the prevalence of tick infestation was different with different risk factors like breed, sex, age and body condition of animals.

The overall prevalence of tick infestation was different in two breeds of cattle. It was found that the overall prevalence of tick infestation was 74.00% and 52.80% in local breed and cross breeds of cattle respectively. There was highly statistically significant difference (p = 0.001) between the two breeds of cattle as indicated in Table 3.

The overall prevalence of tick infestation in cattle was different with two sex groups of cattle. It was found that the overall prevalence of tick infestation was 75.70% and 66.00% in males and females respectively. The difference was not statistically significant difference (p>0.005) as indicated in Table 3.

Table 1: Prevalence of tick infestation of cattle in the study area

Breed of cattle	No of animals examined	No of infested animals	Prevalence (%)
Local	331	246	74.00
Crossbred	53	28	52.80
Overall	384	274	71.34

Table 2: Identified species of ticks with their prevalence in the study area

Species of ticks identified	No of positives (prevalence in %)
Amblyomma variegatum	152 (39.50)
Rhipicephalus (*Boophilus*) *decoloratus*	59 (15.40)
Amblyomma coherence	41 (10.70)
Rhipicephalus evertsi evertsi	16 (4.20)
Hyalomma rufipes	6 (1.60)
Total	274 (71.34)

Table 3: Association of the prevalence of tick infestation of cattle with different risk factors

Risk factors	Total examined	No of positives (Prevalence in %)	χ^2	p-value
Breed				
Local breed	331	246(74.00)	203.24	0.001
Cross breeds	53	28(52.80)		
Sex				
Male	210	159(75.70)	3.37	0.066
Female	174	115(66.00)		
Age				
<1 years old	130	96 (73.80)	141.06	0.001
1-3 years old	222	155(69.80)		
Above 3 years old	32	23(71.80)		
Body Condition				
Poor	109	85(77.90)	71.76	0.001
Good	275	189(68.70)		

The overall prevalence of tick infestation in cattle was different with different age groups of animals. It was found to be 73.80%, 69.80% and 71.80% in animals with the age of less than 1 years, 1-3 years and greater than 3 years respectively; and the difference was highly statistically significant (p = 0.001) as indicated in Table 3.

The overall prevalence of tick infestation in cattle was different with different body condition of animals. It was found to be 77.90% and 68.70% in poor and good body condition animals respectively. There was highly statistically significant difference (p = 0.001) between the two groups of animals as shown in Table 3 below.

DISCUSSION

In this study, attempts were conducted to assess the prevalence of tick infestation of cattle and to identify the major species of tick affecting cattle found in and around Asella town. In addition, the association of the prevalence of tick infestation of cattle with different risk factors was also assessed. The present study showed that ticks were common ectoparasites of cattle in the study area. The result of the present study showed that the overall prevalence of tick infestation of cattle in the study area was found to be 71.34% (Table 1). However, the prevalence of tick infestation of cattle was different with different breeds of cattle and it was 74.00% and 52.80% in local and cross breeds of cattle respectively (Table 1). The prevalence of tick infestation of cattle in present finding was much greater than the works of Kassa and Yalew [20] and Tesfaheywet and Simeon [21] who reported 33.21% and 16.00% in Haramaya district and in Benchi Maji Zone of the Southern Nations and Nationalities of Ethiopia, respectively. In contrast to this, study that was done in Western Amhara Region by Nigatu and Teshome [22] showed a higher prevalence of

tick infestation of cattle (89.40%). Such differences in prevalence might be arise from differences in seasons of study, sample size, agro-climate condition, management and difference in awareness of the society for health care of cattle in the study sites.

The distribution and abundance of the most common tick species infesting cattle in Ethiopia vary greatly from one area to another. In this study, *Amblyomma variegatum* was found to be the most abundant tick species that was identified from infested cattle in and around Asella town. *Amblyomma variegatum* was identified with prevalence of 39.50% (Table 2) in the study area during the study period. Similar finding was reported by Tesfanesh [23] in North Omo with prevalence of 40.1%. However, slightly greater finding was reported by Behailu [24] in Asella with prevalence of 48%. The results were in total agreement with those described by Morel [25] and Pegram *et al.* [26] which describe that *Amblyomma variegatum* is the most widely distributed species of cattle tick in Ethiopia and has a great economic importance.

Rhipicephalus decoloratus was the second abundant tick species of cattle which was identified in the study area. It was identified with prevalence of (15.40%) (Table 2). Similar findings were reported from many parts of Ethiopia, This finding slightly agrees with that of Tamiru [27] in and around Asella who reported 15.4% tick infestation prevalence. On the other hand, the finding was lower than the report of Bossena and Abdu [28] with the tick infestation of 70.3% in and around Asossa town, western Ethiopia. On the other hand, Regassa [29] reported a lower prevalence of 1.60% at Borena ranch. This might be due to the management differences as the ranch have had its own tick control measures on relative bases that reduces tick burden on study animals. But on contrary to our finding, Morel [25]

stated that *R. decoloratus* is very often collected from cattle in Ethiopia and do not seem really abundant anywhere. This tick species is abundant only in wetter highlands and sub-highlands of the country, receiving more than 800 mm rainfall annually. Pegram *et al.* [26] also described that *R. decoloratus* has similar distribution like that of *Amblyomma variegatum*. Such difference in prevalence of *R. decoloratus* might be arise from the differences in the time when the studies were conducted as the agro-ecology of the country might be changed because of global warming and the difference in veterinary service and awareness of the society.

In this study *A. cohaerens* was found to be the third (10.7%) abundant tick species in the area. Similar findings were reported by Pawlos and Derese [30] with prevalence of 11.2% in Humbo district of SNNPR, Ethiopia. Other researches like Yitbarek [31] indicated *A. choherense* (62.4%) to be the most abundant tick infesting cattle in West Ethiopia. This difference could be due to the preference of the tick to prefer wetter highlands and sub highlands receiving >800 mm rainfall annually [26]. It has also been reported the prevalence in many other parts of the country such as Rift valley [26, 31] and in highland areas of Harar and Diredawa district [32].

Rhipicephalus evertsi evertsi was fourth abundant tick species that was identified from infested cattle in the study area. It was identified from infested cattle with the prevalence of 4.20% (Table 2). However, the current finding was disagreed with findings those were reported by Tamiru [27] in Asella town with the prevalence of 22.00%. The differences might be due to variation of environmental conditions, study season, feeding and management of animals, differences in using veterinary service and study design that could have great contribution for this variation.

H. rufipes was found to be the least abundant tick species that was identified from infested cattle in the study area. It was identified with prevalence of 1.60% (Table 2). This result is slightly agreed with 1.20% of Yussen [33] and 2.50% report of Tamru [27] in and around Bako and Assella, respectively. However, the current finding was higher than that of 0.08% report by Regassa [29] in Borena zone of Ethiopia. This is because *H. rufipes* is restricted in the areas of warm, moderately dry mid lands between altitudes of 1800 to 1950masl. This finding was in total agreement with those described by Hoogstraal [34] who reported that *H. rufipes* is widely distributed in the most arid parts of tropical Africa, receiving 250 to 650 mm annual rainfall. His finding concurred with our result as the study area was not arid.

In this study, the major predilection sites of the four identified species of ticks on the animals were assessed; and it was found that each species of ticks preferred different sites on the body of cattle. The most favorable predilection site for *A. variegatum* and *H. rufipes* were found to be the ventral part of animals (udder/scrotum, axial and groin). However, *R. decoloratus* was mostly found on dewlap, head and back; and on the rest of body parts of infested cattle while *R. evertsi evertsi* was found most often under tail, vulva area and perennial region of infected cattle. This finding was in total agreement with findings those were reported by Solomon *et al.* [35] in Kobo-Girana Valley of North Wollo Administration Zone, Amhara region. This is because variety of factors like host density, interaction between tick species, time and season of the year and inaccessibility for grooming determine the attachment site of ticks [35].

This study was also focused to know the presence or absence of association between the prevalence of tick infestation of cattle with different risk factors. It was observed that the overall prevalence of tick infestation of cattle was different with different risk factors (Table 3). It was 74.00% and 52.8% in local breed and cross breeds of cattle, respectively. The result showed that there was highly statistical significance difference (p = 0.001) in prevalence tick infestation of cattle between the two different breeds of cattle (Table 3). Tick infestation was significantly higher in local breed cattle as compared with cross cattle, where p<0.05 (p=0.001) and this finding is in agreement with the findings of Kasier *et al.* [18]. The higher prevalence of tick infestation in local breed animals may be attributed to the currently existing modified animal husbandry practice where cross breed/high yielding animals are kept most of the time indoor with semi-intensive care, whereas local breed cattle are kept under extensive farming system. Therefore, the chance of occurrence in local breed cattle is greater than cross breeds.

The association of the prevalence of tick infestation of cattle with different age group of animals was assessed; and it was found that the prevalence of tick infestation of cattle varies with different age categories of cattle; and it was found to be 73.80%, 69.80% and 71.80% in animals with the age of less than 1 years, 1-4 years and above 4 years, respectively. The difference was statistically significant (p<0.05) (Table 3). The proportion of tick infestation was higher in adult animals as compared to young animals. The higher proportion may be due to outdoor management and of long distant movement of adult animals to search feed and water as compared to

younger animals, so the chance of exposure was higher. This finding is also in agreement with the findings of Feseha [36], the higher proportion in adult cattle.

The association of the prevalence of tick infestation of cattle with different body condition of animals was also assessed; and it was found that the prevalence of tick infestation of cattle varies in animals with different body conditions; and it was found to be 77.90% and 68.70% in animals with poor and good body condition animals, respectively (Table 3). Statistical analysis showed that there was highly statistical significance difference (p=0.001) in prevalence tick infestation of cattle between animals with two different body condition scores (Table 3). This might be due to the fact that medium body scored animals are exposed to any kind of diseases when grazing on the field and poor body conditioned animals were kept at home due to their inability to walk long distant areas, so they become less infested than medium sized animals but, the well fed animals were very resistant to any kind of diseases when they grazed in the field or are kept at home [37].

CONCLUSION AND RECOMMENDATIONS

The present study identified the distribution of five ixodid tick species such as *R. decoloratus, H. rufipes, A. variegatum, R. evertsi everts* and *A. cohaerens* that belongs to three tick genera, *Hyalomma*, *Amblyomma* and *Rhipicephalus*. In this study, *Amblyomma* was the most abundant and widely distributed tick genus in the study area and *Hyalomma* was the least prevalent. *A. variegatum* causes the greatest damage to hides and skins because of its long mouth part which renders the commodity valueless on world market if the infestation is high. Generally, there should be seasonal pasture treatment and cattle before and after rainy season. An awareness creation on routine investigations of tick species and their control measures should be adopted by various groups of cattle producers.

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