Prevalence and Species of Ticks on Cattle in Borecha District, Southern Ethiopia

Jelalu Kemal[1*], Mathewos Israel[2], and Sisay Alemu[1]

[1]College of Veterinary Medicine, Haramaya University, P. O. Box 138, Dire Dawa, Ethiopia.
[2]Borecha District Agricultural and Rural Development Office, Southern Ethiopia.

Abstract: A cross sectional study was conducted from October 2014 to June 2015 to identify and estimate the abundance of bovine tick species. The ticks were collected from different attachment sites on cattle kept under extensive management system. Among the 384 animals examined, 63 percent (n=242) were infested by one or more tick species. A total of 4246 adult ticks were collected and five tick species belonging to two genera, namely *Amblyomma* and *Rhipicephalus* were identified. The prevalence of tick infestation in animals with poor body condition (73.95%) was significantly ($P<0.05$) higher compared to animals with good body condition (52%). The prevalence of tick infestation among the age groups was significant ($P<0.05$) and higher in old than young and adult. *Boophilus* tick species infested all body regions of animals. *Amblyomma s*pecies concentrated on the scrotum/udder regions whereas *Rhipicephalus* were restricted to the ear, neck, udder/scrotum, ano-genital and tail of the animals. The prevalence and abundance of tick in the present study is high and can reduce animal productivity. Therefore, appropriate and strategic tick control program should be formulated and implemented and this should be based on the distribution pattern of the tick species.

Keywords*: Bovine; Tick; Prevalence; Tick burden*

Introduction

Ethiopia has the largest livestock population in Africa and livestock contribute to the livelihoods of over 80% of the rural population by providing food such as milk and meat, and foreign currency earning to the country from export of live animals, hides and skins (Fufa *et al*., 2009). The utilization of hides and skins in Ethiopia is estimated at 48 for cattle, 75 for goats and 97% for sheep with off take rate of 7, 35, and 33%, respectively (Mahmud, 2000). Though hides and skin are very important source of export income, its contribution to the national economy is far below the expected potential mainly due to external parasite such as ticks (Kassa, 1998; Hagos *et al*., 2013) that cause significant economic losses through rejection and down grading of hides and skins.

Ticks and Tick Borne Diseases (TBDs) are widely distributed throughout the world, particularly in tropical and sub-tropical regions. It was estimated that 80% of the world's cattle population is exposed to ticks infestation (Fufa *et al*., 2009). Ticks have developed resistance to many classes of acaricide including organophosphates, formamidines (amitraz) and other acaricide group in different regions of the world. Target site mutations are the most common resistance mechanism observed, but there are examples of metabolic mechanism (Shearer and Wall, 2008). In Ethiopia, tick and tick borne diseases cause considerable losses to livestock industry and accounts for 75% of the animal exports loss. A conservative estimate of 1 million birr loss annually was incurred through rejection and down grading of hides and skin in the country (Hagos *et al*., 2013). Apart from direct effect on animal production and productivity, ticks are inviolably efficient vectors of pathogens to man and domestic animals (Pegram *et al*., 1981; Rahbari *et al*., 2009).

According to Walker *et al*. (2003) ticks that are considered to be most important to the health of domestic animals in Africa comprise about forty species. Among these, the most important tick species in cattle are *Amblyomma gema, A. varigatum*, A. cohaerens, *A. lepidum* (Sileshi *et al*., 2002; Ammanuel and Abdu, 2014), *Boophilus, decoloratus* (Sileshi, 2002), *B. annulatus* (Tamiru and Abebaw, 2010) *Rhipicephalus pulchellus, R. pravus, R. everts everties* (Alemayehu, 2000), and *Haemaphysalis aciculifer* (de castro, 1994; Mesele *et al*., 2010). The environmental condition and vegetation of Ethiopia are highly conducive for ticks and tick-borne disease perpetuation (Pegram *et al*., 1981).

The infestation of tick results in retardation of animal growth, loss of milk, and meat production by affecting the market desirability (Tsegaye *et al*., 2014). Even though various researches were carried out in different parts of the country, there were no studies conducted regarding tick infestation problem and tick species distribution in the present study area. Therefore, the present study was designed to estimate the prevalence, identify tick speciesand associated risk factors.

Materials and Methods

Study Area

The study was conducted in four selected Kebeles (Yirba dumancho, Bonoyachire, Konsore fulassa and Sadamo dikicha) of Borecha district, Sidama Zone, Southern Ethiopia. Borecha is located at about 304 km from Addis Ababa, the capital city of Ethiopia. It has a total land mass of 39, 504 hectare out of which about 17,934, 17,778, and 6,487 ha were covered by perennial crops, forest and grazing land, respectively. Administratively, there are 39 rural kebeles and 4 urban Kebeles. It has an altitudinal range of 1700-2000 above sea level and its agro-ecological condition is 22% highland and 78% lowland. The average annual rainfall ranges from 1232

*Corresponding Author. E-mail: jelaluk@gmail.com

mm – 1242 mm and the annual average temperature is 16-29.8 ^{o}C.

Study Animals

The study population constituted local breeds that were available in the study area. Cattle in the rural areas are indigenous zebu breed kept in traditional management system. The animals depend on grazing throughout the year with little supplementation of crop residues.Cross breed cattle are increasing in number and they are primarily reared around urban and peri-urban areas.

Study Design

A cross sectional study was conducted from October 2014 to June 2015 to identify tick–species and their preferred site of attachment on the animal body. All animals investigated were categorized in to age, sex, season, and body condition score (BCS) (Table 1). The age of the cattle were grouped into young (1 to 2 years), adult (3 to 7 years) and old (>8 years) as described by Gatenby (1991). The BCS of the animals were categorized into poor and good based on the appearance of ribs and dorsal spines as applied for indigenous cattle (Nicholson and Butterworth, 1986). Samples were collected both in dry (December, January and February) and wet season of the year (October, November, March and April).

Sampling Method and Sample Size Determination

The study Kebele's were purposively selected based on the availability of transportation and logistics as well as their agro-ecological representativeness of all Kebele's of the district. From each selected Kebeles, the animals were selected by simple random sampling method. The sample size was determined by using the formula given by Thrustfield (1995). The expected prevalence of Ixodidae ticks of cattle in the district was assumed to be 50% since there was no known research conducted in the study area. The parameters used were 95% confidence interval and 5% desired level of precision. Accordingly, the sample was determined by employing the formula: $N = 1.962\ pexp\ (1\text{-}pexp)/d^2$, and by substituting these values in the formula, the sample size determined was n = 384. Where n = sample size; pexp = expected prevalence; d^2 = expected precision which is usually 5% (0.05).

Table 1. Study animals in terms of age, sex, season, and body condition score

Factors	Categories	Number of animals examined
Sex	Male	92
	Female	292
Age	Young	59
	Adult	296
	Old	29
Body condition	Good	192
	Poor	192
Season	Dry	139
	Wet	245
Kebele	Yirba dumancho	112
	Bonoyachire	100
	Konsore fulassa	81
	Sadamo dikicha	91

Tick Collection and Identification

First, the animals were properly restrained and checked for any tick infestation. Adult ticks were collected from half body regions such as ears, heads, dewlaps, belly/flunk, udder/scrotum, fore/hind legs, perineum and tails. Ticks were removed carefully and gently in a horizontal pull to the body surface. The collected ticks were preserved in universal bottles containing 70% ethanol and labeled with respect to predilection site, age, sex, BCS of the animal, and date of collection and transported to district veterinary laboratory. Ticks were counted and subsequently identified to genus and species level by using stereomicroscope according to standard identification keys given by Walker *et al.* (2003).

Data Processing and Analysis

The data collected were entered and managed in Microsoft excel. STATA (STATA Corporation, 2001) was employed for the data analysis. The overall prevalence of tick was determined by dividing the number of positive animals by total sample size and was expressed as percentage. Chi-square (x^2) test was used to assess the association in tick infestation between different variables.

Results

Overall Prevalence

Out of the 384 animals examined, the prevalence of ticks was 63.02% (n=242) and the animals harbored at least one tick species of varying number (Table 2). There was no difference among the study kebeles.

Table 2. Prevalence of tick infestation in cattle by the sample Kebeles

Kebele	No of animals examined	No of positive	Prevalence	χ^2	p-value
Yirba dumancho	112	66	58.9%	15.02	0.89
Bonoyachire	100	64	64%		
Konsore fulassa	81	62	76.5%		
Sadamo dikicha	91	50	54.9%		
Total	384	242	63.02%		

Relative Abundance of Tick Species

Boophilus decoloratus is the most commonly found tick species followed by *Ambylomma lepidium*, *Ambylomma varigatum,* R*hipiepcephalus eversi* and R*hipiepcephalus mushamae,* respectively (Table 3).

Table 3. Frequency of tick species identified in Borecha district

Tick species	Frequency	Percentage
B. decoloratus	2570	60.53
Lepidium	814	19.17
Varigatum	378	8.17
R. eversi	320	7.54
R. mushamae	164	3.86
Total	4246	100

Prevalence of Tick Infestation by Different Risk Factors

The overall prevalence of tick infestation was 63%. There was no significant difference in the occurrences of tick infestation among the study Kebeles (Table 2). Slightly numerically higher prevalence was recorded in Yirba duwancho Kebele (41.5%) and lower prevalence in Sadamo dikicha Kebele (31.5%). The occurrence of tick infestation were not significantly different ($p>0.05$) between sex. There was statistically significant association between age of the animals and level of tick infestation ($P<0.05$) (Table 4) in which older animals recorded the highest prevalence Animals with poor body condition had higher tick prevalence than animals with good body conditions (Table 4). There was no variation in tick infestation between seasons of the year ($p>0.05$) (Table 4).

Table 4. Prevalence of tick infestation in cattle of the study district by sex, body conditions, age and season

Factors	No of animals examined	No of positive Animals	Prevalence	χ^2	p-value
Sex					
Male	92	61	66.30%	9.36	0.69
Female	292	181	61.98%		
Age					
Young	59	33	55.93%	5.33	0.003
Adult	296	185	62.5%		
Old	29	24	82.75%		
Body condition					
Good	192	100	52%	6.8	0.0001
Poor	192	142	73.95%		
Season					
Dry	139	83	59.71%	3.55	0.36
Wet	245	159	64.89%		
Total	384	242	63.02%		

Distributions of Tick Species on Different Body Parts of the Animals

A total of 4246 ticks belonging to five tick species of two genera were identified. *Rhipicephalus (Boophilus) decoloratus* was the most abundant tick species followed by *A. lepidum, A. varigatum, R. evertsi and R. mushamae* in decreasing order (Table 5). *Boophilus* tick species infested all body regions of animals, *Amblyomma s*pecies are concentrated on the scrotum/udder regions whereas *Rhipicephalus* was restricted to the ear, neck, udder/scrotum, ano-genital and tail of the animals.

Table 5. Species of ticks and their distribution on body regions of cattle in the study area

Body region	*A. varigatum*	*A. lepidum*	*B. decoloratus*	*R. evertsi*	Total
Ear	0	0	6 (40)*	10 (92)	16 (132)
Face	0	0	41 (222)	0	41 (222)
Neck	1 (6)	1 (2)	126 (1308)	2 (182)	130 (1494)
Brisket	8 (30)	13 (46)	38 (136)	0	59 (212)
Abdomen	2 (14)	2 (10)	76 (498)	0	80 (526)
Limbs Scrotum	14 (42)	14 (72)	36 (222)	0	54 (336)
Udder	54 (262)	85 (652)	14 (78)	1 (4)	154 (996)
Back	1 (6)	0	13 (38)	0	14 (44)
Ano-gential	5 (18)	11 (32)	1 (2)	49 (202)	96 (254)
Tail	0	0	8 (26)	1 (4)	9 (30)
Total tick	378	814	2570	484	4246

Numbers indicate animals harboring tick and count/burden of ticks, respectively.

Discussion

This study revealed that ixodid ticks are widespread and most significant external parasites of cattle in the district with an overall 63.02% prevalence. The animals are infested with at least a single tick. This finding is in line with previous result reported by Ammanuel and Abdu (2014) who found 62.04% infestation rate in Wolaita Zone, Ethiopia. The result is comparable with Meaza *et al.* (2014) who reported 74% at Bahirdar. However, higher prevalence (89.4%) was reported by Nigatu and Teshome (2012) in western Amhara. Mesele *et al.* (2010) reported 97.8% prevalence which is by far higher than the current prevalence rate. Lower prevalence (27.3%) and (25.6%) was reported by Addisu and Addis (2015) at Bench Maji zone and Belew and Mekonnen (2011) at Holeta, central Ethiopia, respectively. This prevalence variation is most probably attributed to the differences in the agro-climatic condition and agro-ecology among the study areas. Tick activity can be influenced by rainfall, temperature, altitude and atmospheric relative humidity (Pegram *et al.*, 1981).

Although there are different species of ticks known to be found in other parts of the country (Tsegaye *et al.*, 2014), only five species were identified in the present study. *B. decolaratus* was the most abundant tick species in the district (60.5%). This is in agreement with Sileshi *et al.* (2007) who noted *B. decolaratus* to be the commonest and most wide spread tick in Ethiopia among the ticks collected across all regions of the country, except Afar region. This is also in line with the findings of Tamiru (2008) in Asela, and Abebaw (2004) who reported the highest prevalence of *B. decolaratus* (80%). Lower prevalence of this species was reported by Alekaw (1998) in Metekel Ranch (5%), Ethiopia and Mesele *et al.* (2010) at Bedelle district (23.7%). This difference is attributable to the geographical location and altitude of the study areas since this tick species is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually (Pegram *et al.*, 1981).

A. lepidium was the second most abundant tick species in this study area. This tick is an important vector of *Cowdria ruminatum* which cause heart water in cattle (Walker *et al.*, 2003). This tick was reported by several workers (Pegram *et al.*, 1981; Sileshi, 1995; Mesele *et al.*, 2010) in different part of the country and with varied prevalence. The tick is irregularly dispersed throughout most parts of the country. It occurs in arid and semi-arid areas and also in woodland, bush land as well as grassland with either trees or bushes present (Horak *et al.*, 2011).

A. varigatum was the third most abundant tick species in this study. Mesele *et al.* (2010) reported 14.1% prevalence of this species. The result reported for the survey conducted in western Shoa Bako district by Hussen (2009) indicated this tick species to be the first most abundant species with prevalence of 54.3%. Meseret *et al.* (2014) and Latif and Walker (2004) reported 38.87% and 32.2% prevalence at Haramaya district and Fiche Selale, respectively. Moreover, Solomon *et al.* (2007) noted this species to be the second abundant in cattle in Ghibe Tollay area showing seasonal peaks from April to June. The difference in result was due to the geographical location. *A. varigatum* is a potential vector of diseases caused by *C. rumintium, T. mutan*, *T. velifera* (benign bovine thelieriasis), viral disease, Nairob sheep disease and also aggravates the situation of bovine dermatophilosis (*D. congolence*) (Sileshi *et al.*, 2007).

Rhipicephalus eversi eversi is the fourth abundant tick species (7.5%) in the present study area. The prevalence of this species is lower than reports by Solomon *et al.* (2007) (21.19%) at Ghibe Tullary in central Ethiopia. This tick shows an apparent preference for any particular altitude, rainfall or season (Pegram *et al.*, 1981). It is a possible vector of *Babesia, Rickettisa* and *Theleria* (Kettle,

1995). The occurrence of this species in and around the study area was also reported by other authors (de Castro 1994; Sileshi, 1995; Sileshi *et al*., 2007). *R. mashamae* is the fifth and least tick abundant species (3.9%) identified in the area. In this study only 164 ticks were collected.

Tick infestation in the current study was significantly associated with age of the animals ($p<0.05$) in that older animals had significantly higher tick loads than adult animals. This is probably associated with a decrease in the immunity as the animals get older. Significant difference ($p<0.05$) was recorded among different body condition score groups with the higher prevalence in poor animals. Similar prevalence of tick infestation between the different sample Kebeles was due to the similarity of the environment.

With regard to distribution pattern of ticks on the animal body, *B. decolarantus* was collected from all examined body region, even though the frequency of occurrence is more in the areas extending from face to the limbs, and less on ear, back, ano-gential and tail regions. This species was also the commonest tick collected accounting for 60.5% of all ticks on the study animals. *R. evertsi* and *R. mushamae* were the most restricted tick species identified. They were restricted to the ears, the neck and ano-gential areas with very few of them observed on the scrotal/udder area. *Amblyomma* species were more fairly distributed than *Rhipicephalus* counterparts, with the exceptions of their absence from the ear, face, back and tail. *Amblyomma* spp were more concentrated in the areas of scrotum or udder. The neck, udder and scrotum areas were affected with the highest number of tick (55.4%) followed by abdomen, ano-genital and limbs. Of the total 242 animals affected 154 (63.6%) of them had ticks on the scrotum or the udder depending on the sex of the animal. The previous findings of Okello-Onen *et al.* (1999), Solomon and Kassa (2001), Walker *et al.* (2003) and Belew and Mekonnen (2011) supported the present finding regarding the attachment sites of ticks. Several factors may determine the attachment site of ticks such as host density, interaction between tick species, time and season and inaccessibility for grooming. Information on predilection sites of ticks can increase the efficiency of control methods and aids sampling.

Conclusion and Recommendations

This study showed high burden of ticks in the area with an overall prevalence of 63.02%. The most important and abundant tick species were *B. decolaratus*, *A. lepidum*, *A. varigatum*, *R. evertsi* and *R. mushamae*. The predilection sites identified for the tick species will help in designing tick control methods. Heavy infestations by different tick species can suppress the health of cattle, damage teats, hide and skin and reduce productivity of animals. Therefore, appropriate and timely strategic tick control program should be formulated and implemented based on the distribution pattern of ticks and factors responsible for their devastation.

Acknowledgments

We would like to thank Dr. Kokeb Kore, Mr. Sintayou Alemu, and Mr. Abidisa Oshonu of Hawassa University and Dr. Habtamu Alemayehu of Borecha district veterinary open air clinic for their advice, support and encouragement during the work. We also would like to grateful to all those directly or indirectly engaged in this work.

Conflict of Interests

The authors declare that they have no competing interests.

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