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Prevalence of Ixodid Ticks on Cattle in and Around Diga Town, West Ethiopia

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Abstract: The prevalence of bovine tick species in and around Diga town was studied over a period of six months from November 2013 to April 2014. Adult ticks were collected from 394 local and crossbred cattle which were kept under extensive management system. A total of 1444 adult ticks were collected from part of cattle and were identified to genera and species level. Four tick species of three genera were identified, in which two species belong to genus *Amblyomma* and one species each in the genus *Rhipicephalus* (formerly *Boophilus*) and *Rhipicephalus*. Of all the total ticks collected, *Amblyomma*, *Rhipicephalus* and *Rhipicephalus* (formerly *Boophilus*) constituted 68.4%, 16% and 15.6% respectively. The tick species encountered were *A. variegatum* (50.0%), *A. coherence* (18.5%) *R. evertsi-evertsi (*16%) and *R.* (*B.*) *decolaratus*(15.5%). The sex ratios of all tick species identified were skewed towards male (1.4:1) except for *R.* (*B.*) *decolaratus*. The prevalence of tick infestation was significantly associated with body condition of animal ($P < 0.05$) whereas no statistically significant association was observed among age groups, between sex groups and different localities ($P > 0.05$).

Key words: Amblyomma · Bovine · Tick genera · Tick species

INTRODUCTION

Cattle play a significant role in the socio-economic life of the people of Ethiopia. In addition to the products of meat and milk cattle provide draught power for cultivation of the agricultural lands of many peasants. Skins and hides are also important components of the livestock sector in generating foreign export earnings [1, 2].

A total of 896 valid tick species (702 Ixodid, 193 Argasid and 1 Nuttalliella tick species) have been recorded from all climatic zones throughout the world [3].Over 79 different species are found in eastern Africa but many of these appear to be of little or no economic importance [4]. In Ethiopia, there are 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 [5]. Ticks, besides being important vectors for diseases like theilerosis, anaplasmosis, babesiosis and rickettsiosis in domestic animals; they also cause nonspecific symptoms like anemia, dermatosis, toxicosis and paralysis [6].

Different tick species are widely distributed in Ethiopia and a number of researchers reported the distribution and abundance of tick species in different parts of the country. *Amblyomma* tick is one of the most abundant tick genera and has been reported in many parts of the country, such as Bedelle [7], Nekemte [8], Hararghe [9], Asella [10], MizanTeferi [12] and Jimma [13], with highest prevalence rate. *Rhipicephalus* is also predominant genera and has been reported with highest prevalence in Gamo Gofa [14], Bale [15] and Southern Sidamo [16].

Although *Amblyomma* and *Rhipicephalus* ticks are predominating in many parts of the country, *Rhipicephalus* (*Boophilus*) and *Hyalomma* ticks also have a significant role. The population changes of tick are influenced by climatic changes, which affect the rate of tick population on the ground, host resistance and natural enemies [6]. *Amblyomma cohaerence* is prevalent and abundant in western humid highland areas of Ethiopia. *Rhipicephalus* (*Boophilus*) *decolaratus* and *Rhipicephalus evertsi evertsi* are widely distributed in most altitudinal ranges [17].

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In Ethiopia the conservative estimated losses of 1 million USD was attributed to down grading of hides and Skin due to tick infestation, if the loss from reduced production, death and cost of tick control are included economic lostage was much greater than this estimation. Massive losses from tick and tick borne disease occur mainly in exotic breeds and the lostage was 1% via tick damage on indigenous *Bos indicas* breeds whereas more than 50% on exotic *Bos Taurus* [18]. In order to have the knowledge in the design of more economically efficient tick and tick borne disease control and eradication program, investigating the species of ticks in the study area are the core points [19]. Accordingly if the prevalent ticks are known to a specific area with their preferred hosts, it was an easy task to have an intervention. Intervention can be controlling tick burden and prevention of their occurrence together with the disease they probably transmit.

The objective of this study was to determine the prevalence of tick infestation and to determine the prevalence of tick species, identify tick genera and species and to measure the tick burden of cattle and related risk factors in Diga town and its surrounding.

MATERIALS AND METHODS

Study Area

Diga: The study was conducted from November 2013- April 2014 in Diga district. Diga was located 345 km distance from western of Addis Ababa the Capital city and 12 km from the zone town Nekemte, East wollega zone, at altitude of 2250 masl. Its zone receives the annual average rain fall of approximately 1250mm. The annual temperature varies from 14°C – 32°C with average temperature 22.6°C [20].

Out of the four seasons, summer was hot and winter was cooler. There are two rainy seasons namely The Summer and spring. The rain shower falling in the spring season was medium which was very important for growth of plants as whole. The main rain season for the study area was summer where by sufficient rain and moisture was available for plant growth. The total area of the study area was 586,330 hectare and three ecological locations. It was characterized by crop livestock mixed farming system. Teff, Wheat, barley, maize, sorghum, peas, beans, chickpea, linseeds, Nug and rape seed are the major annual crops grown in the area. The estimated animal population of the area was 67,060 cattle among cattle population 15 pure Borena breed, 144 cross breed (holystein feresian with zebu breed), 11,893 sheep, 6,426 goats, 3066 donkey, 147 horses and 48 mules [20].

Study Population: The cattle population are estimated to be 67,060, of which about are 66,901 zebu breeds, 15 borena breed and 144 cross breeds. In this study area 384 cattle population were randomly selected from the total population [21].

Sampling Method and Sampling Technique: A cross sectional study was conducted from November 2013- February 2014 to determine the prevalence of tick species in the study area. Simple random sampling would be subjected on the study population (67,060). As zebu breeds are dominant in number in the study area and due to this fact zebu breed was found to be dominant after sampling.

Sample Size: The sample animals were selected by systematic random sampling techniques, at predefined intervals from animals' coming to Diga veterinary clinic. Animals came from different kebeles to this clinic, mainly from Fromsa, Gudisa, Jirata, Garuma, Ifa and Gemechis. Name of the attendants and their respective animals that are sampled were recorded to avoid a risk of repeated sampling. The required sample size for the study was determined by the formula given by Thrusfield [22] at 50% expected prevalence, 5% desired precision and 95% confidence interval. Though, the required sample size was computed to be 384, a total of 394 animals were examined to increase the precision of our investigation.

$$n = \frac{1.96^2 \ (pexp \ (1\text{-}pexp)}{d^2}$$

where:

n = Required sample size
1.96 = The value of z at 95%of confidences level.
Pexp = Expected prevalence of tick species (50%)
d = Desired absolute precision level at 95% confidence

According to the formula a minimum of 384 cattle's were sampled; but 394 animals were sampled to increase our precision.

Study Methodology: Ticks are collected and identified for tick species and total tick burden counting was performed on different-body regions of the cattle population.

Tick Collection and Preservation: Ticks were successfully collected from cattle after being restrained using strong crushes, by physical handling. Ticks were collected by searching on different regions of the animals'

body. The skin of each study cattle was inspected for the presence of ticks. All adults (Both sexes) were collected by using universal bottles; collected ticks were preserved in 70% ethyl alcohol and transported to National livestock diagnostic laboratory for tick identification at species level.

Laboratory Techniques for Tick Examination: First ticks were seen grossly and classified to different genera levels. Ticks were identified into their species level depending up on their morphological structures. During tick identification in the laboratory the sample were put on petridish and examined under stereomicroscope.

Data Analysis: The data was analyzed by using (SPSS) statistical package for windows version 20 to get data of descriptive statistics. The prevalence of tick infestation was calculated as the number of positive animals for specific tick species sampled divided by the total number of animals examined and multiplied by hundred. Furthermore, prevalence of each species of ticks was seen together with that of risk factors (Sex, body condition score, age and breed)

RESULT

Distribution of Tick in the Different Kebeles in the Study Area: The prevalence of tick infestation within different kebeles in Diga district in current study out of 85.3% positive animals, fromsa (15.7%), Gemachis (15%), Gudisa (12.7%), Garoma (13.2%), Jiraata (14.2%) and Ifa (14.5%). Absence of great variation among kebeles is due to similar agro ecological zone, climatic condition and s management system (Table 1).

Prevalence and Distribution of Tick Genera and Species Genera: A total of 1444 adult ixodid ticks were collected from body region of 394 cattle population that were sampled and found to be positive for tick infestation. In general, three Ixodidae tick genera and four species were identified from the study area. From identified generas; *Ambylomma* (68.4%) (988/1444) was the most abundant and widely distributed genus followed by genus *Rhipicephalus* (16%) (231/1444). However, *Boophilus* (15.6%) (225/1444) was found to be the least abundant genera (Table 2).

Tick Species Distribution: Ambylomma variegatum was the most abundant tick species and it represents (50%) (720/1444) of the total tick collected followed by *A. coherence* (18.5%) (268/1444). In contrast to this, *Rhipicephalus (Boophilus) decoloratus* (15.5%) (1444) were found to be the least abundant tick species followed by *Rhipicephalus evertsi evertsi* (16%) (231/1444) (Table 4). Male to female sex ratio for tick species of this result indicates higher number of males for most species except *R. (B.) decoloratus* that can have higher ratio of female tick species (Table 3).

Distributions of Tick Species on the Animal: From three generas and four species identified in the study area and their relative infestation rate of *Ambylommavariegatum* (32.0%) ambylommacoharence (24.1%) and *Multi species (23.9)* were more prevalent on the animals of current study. However, *Rhipicephalus. Evertsievertsi* (11.7%) and *Boophilusdecoloratus* (8.4%) were the least tick species found on the body of the animals (Table 4).

Table 1: Prevalence and distribution of tick in the different kebeles in study area

Origin	No. animal	Positive animal	Prevalence %
Ifa	61(15.5%)	57	14.5
Gemachis	67(17%)	62	15.7
Fromsa	74(18.8%)	59	15
Garoma	63(16%)	52	13.2
Jirataa	67(17%)	56	14.2
Gudisa	62(15.7%)	50	12.7
Total	394	336	85.3

Table 2: Distribution of tick genera of cattle in the study area

Genus	Percentage of total tick genera
Ambylomma	68.4% (988/1444)
Rhipicephalus	16% (231/444)
Boophilus	15.6% (225/1444)

Table 3: Distribution and sex ratio of adult tick species

Tick species	Male (M)	Female (F)	M:F	Total	% distribution (Prevalence)
A. variegatum	503	217	2.31:1	720	50
A. coherance	189	79	2.39:1	268	18.5
R. (B.) decolaratus	0	225	0	225	15.5
R. evertsi evertsi	145	86	1.68:1	231	16
Total					100

Am. Ambylomma, Coh. Coherance, Boo. Boophilus,Rhip. Rhipicephalus

Table 4: Distribution of tick species on the animal

	Total Anim.	Examined (n=394)	
Tick spp		Positive animal	Prevalence (%)
Ambylomavarigutum		126	32
Ambyloma Coherence		95	24
Boophilusdecoloratus		33	8.4
RhipicephalusEvertsie		46	11.7
Multispecies*		94	23.9

*= more than one species of tick presented

Table 5: The relation between tick species, breed and sex

		Tick species identified														
		Ambylomma coherance			*Ambylomma varigatum*			*Boophilus decoloratus*			*Rhipicephalus evertsievertsi*			*Multi species*		
Risk factors		+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal
Br.□	Zebu	93	23.9	389	125	32.13	389	33	8.5	389	46	11.8	389	92	23.6	389
	Cross	2	100	2	-	-	2	-	-	2	-	-	2	-		2
	Borena	-	-	3	1	33.3	3	-	-	3	-	-	3	2	66.6	3
Sex	M?	38	20.8	183	55	30	183	15	8.2	183	27	14.8	183	48	26.2	183
	F?	57	27	211	71	33.6	211	18	8.5	211	19	9	211	46	21.8	211

Br.□ Breed, M- Male, F- Female

Table 6: The relation between tick species, body condition score and age

		Tick species identified														
		Ambylomma coherance			*Ambylomma varigatum*			*Rhipicephalus (Boophilus) decoloratus*			*Rhipicephalus evertsievertsi*			*Multi species*		
Risk factors		+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal	+ve animal	%	Total animal
Bcs	Poor	17	27.86	61	12	19.67	61	3	4.9	61	8	13.1	61	16	26.2	61
	Medium	44	24.0	183	32	17.48	183	16	8.7	183	26	14.2	183	47	26.7	183
	good	34	22.6	150	24	16	150	14	9.3	150	12	8	150	31	20.6	150
Age	Young	17	25.7	66	22	33.3	66	5	7.6	66	5	7.6	66	17	25.7	66
	Adult	36	23.7	152	54	35.5	152	14	9.2	152	23	15.1	152	25	16.4	152
	Old	42	23.9	176	50	28.4	176	14	7.9	176	18	10.2	176	52	29.5	176

BCS= body condition score

Table 7: Prevalence of tick based on age, sex, breed and body condition score

Risk factors	Animal tested	Number of positive (%)	P=value	OR (95%)	95% CI
Age					
Young	66	56 (14.2)	0.763	1.131	0.509-2.514
Adult	152	128 (32.5)	0.583	1.187	0.643 -2.191
Old	176	152 (38.6)	-	-	-
Sex					
Female	211	182 (46)	0.557	0.846	0.486- 1.478
Male	183	154 (39.3)	-	-	-
Breed					
Zebu	389	331 (84.01)	0.016	0.953	2.3-19.8
Borenaa	3	3(0.8)	0.153	0.243	3.7-8.77
Cross	2	2 (0.5)	-	-	
BCS					
Poor	61	56 (14.2%)	0.015	0.293	0.109-0.790
Medium	183	165(41.8%)	0.001	0.358	0.194-0.664
Good	150	115 (29.2%)	-	-	-
Ground Total	394	336 (85.3)			

BSC=body condition OR=odd ratio CI = confidence interval

The body condition of cattle was significantly associated with the prevalence of ticks' infestation. The prevalence was 0.293 times than higher in poor body condition than good and medium body condition (p, 0.05).

Risk Factor: In this study the general prevalence of tick infestation was 85.3 % (n=394) from which 84 %(n=331) zebu breeds (Zebu), 0.5 % (n=2) cross breed and 0.8 (n=3) borenaa respectively. The body condition score of the cattle population was found to be variable among tick infestation rate. Accordingly, tick prevalence of medium body condition cattle (41.8%) was more than that of cattle having poor (14.3%) and good body (29.2%) condition. On the other hand, prevalence difference between different age groups shows the presence of high prevalence of ticks in most of cattle having greater than (>7) years of age(38.6%) Table 5).

Sex: Comparison was made on the prevalence of female and male. Out of animals sampled, the majority or 53.5% were females while about 46.5% of them were males. The tick prevalence was 46 % and 39.3 % in female and male respectively (Table 7). However, there was no statistic al (p>0.05) significance between the two sexes.

Age: Analysis of age was prevalence of tick indicated that the difference in prevalence among the three age groups were relatively high in old (Table 7) than the young and adult groups with no statistically significant variation (P > 0.05).

Breed: As indicated in the (Table 7) above, the breed of the sampled animals showed a significant variation, where cross breed animal are less likely(OR=0.953, P=0.016) affected than zebu breed and there is no significant association between cross and borena breeds (p =0.153) the tick prevalence of tick recorded in zebu breed cattle that was about much more frequent than cross and borena breeds [OR (95%) = 2.3-19.8, P = 0.016].

Body Condition Score: As shown in the Table 7 above body conditions of the animals were also considered during examination and animals were divided into three body condition scores as shown in the above table. These are, good, medium and poor. Out of 394 animals examined 150 animals were in good body condition, out of which 115 (29.2%) animals were positive for tick infestation, 183 animals were in medium body condition and out of these 165 (41.8%) animals were positive for tick infestation and the rest 61 animals were poor body condition state and out of these 56 (14.2%) animals were positive for tick infestation. These result shows that body condition have significant relation with tick infestation that Good body condition animal less (OR=0.293, P=0.015) affected by tick than poor body condition animal and medium body condition animal (OR=0.358, P=0.001).

DISCUSSION

In this survey, a total 1444 ticks were collected from a total of 394, Cross, borena and zebu breeds. And animals yielding, Overall prevalence of 85.3%. And this finding is in agreement with the findings of Nigatu and Teshome [23], who reported an overall prevalence of (89.4%). However, it is different from the findings of Belew and Mekonnen [24] who reported an overall prevalence of 33.21%.This difference could be due to the difference in the agro climatic condition of the study areas. Tick activity was influenced by rainfall, altitude and atmospheric relative humidity [18].

Three genera of hard ticks were identified, namely *Amblyomma (68.4%)*, *Rhipicephalus (16%) Rhipicephalus (Boophilus) (15.6%)* and. four species of ticks namely *A.variegatum (50%), A. coherence (18%), R. evertsi evertsi (16%)* and *R. (B.) decoloratus (15.5%)* were identified in the study area. *Amblyomma variegatum* was the most abundant of all tick species comprising 50% of the collected ticks in the study sites. Similar results have been reported by Tesfanesh Gebremichael [25] in North Omo, Mehari Birhane [11] in Awassa and Behailu Assefa [10] in Asella. And this could be due to the fact that *A. variegatum* is the most common and widely distributed cattle tick in Ethiopia [10]. It has a great economic importance, because it is an efficient vector of *Cowderia ruminatum* and greatest damage to skin and hide, due to its long mouth parts, so it will reduce the value on world market [6]. Also, ulcer caused by this tick species becomes favorable site for secondary bacterial infection like *Dermatophilus congolensis*.

As the study performed in western part of the country *A. coharence* was the second abundant tick species (18.5 %) found in the study area. Because, in western Ethiopia, where the climate is humid much of the year, *A. cohaerence* is the most prevalent and abundant tick on cattle [18]. In tick survey conducted in western Ethiopia, *A. cohaerence* was founded to be the most prevalent in Mezanteferi [12] and Jimma[13] with a prevalence rate of 50.5% and 83.1%, respectively.

Rhipicephalus evertsi evertsi was the third abundant tick species constituting 16% of the total adult tick collected which is comparable with the findings of Solomon *et al*. [26]. Hoogstral [27] described its wide distribution throughout the Ethiopian faunal region. Pegram *et al.* [18] reported that this species had not showed specific preference for a particular altitude, rainfall zones or seasons; and it is also known to convey tick paralysis in Harar Ethiopia [28].

Rhipicephalus (Boophilus) decolaratus is the fourth abundant tick species in current study site(15.5%), similar finding also been reported in many parts of Ethiopia, such as in Rift Valley [6] and in Girana valley of North Wollo [29]. Contrary to our results, Morel [28] stated that *Boophilus decolaoratu*s is often collected in Ethiopia and does not seem really abundant anywhere. This tick species is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually [18] and has similar distribution to *A. variegatum*. *Rhipicephalus (Boophilus) decolaratu*s can transmit *Babesia begmina* and *Anaplasma marginale* to cattle and severe tick infestation can lead to tick worry, anorexia and anemia [30].

The male to female rations of *A. Variegatum* (2.13-1), *A. cohaerence* (2.39-1), *R. evertsi-evertsi* (1.68-1) and *R. (B.) decolaratus*, were similar to previous reports of Zenebe [29]; Solomon Gebre *et al.* [6]. Except *R (B.)*

decolaratus, all other species of tick's males outnumbered females because males normally remain on the host longer than females. Fully engorged female tick drops off to the ground to lay eggs while male tends to remain on the host up to several months to continue feeding and mating with other females on the host before dropping of Solomon Gebre *et al*. [6]. The females of *R. (B.) decolaratus* outnumbered males in this study probably due to small size of male which may not be seen during collection.

During the study period, the prevalence of tick infestation was assessed between sexes of animals and among 336 animals infested with tick 182 (46%) of them were female animals and 154 (39.3%) of them were male animals. The tick infestation in female animals was similar with male animals; this shows that both male and female cattle were equally susceptible to tick infestation. Incurrent study there is no significant association of tick infestation between sexes of animal. This founding agree with Endale [31] that there existed no significant difference ($p>0.05$) in the prevalence of ticks between the different sex and age. This could be related to management system where animals are allowed together in communal fields in the mixed.

In the current study Breed Tick infestation was significantly higher in zebu breed cattle as compared with cross, borena cattle where $P < 0.05$ ($P = 0.016$) and this finding is in agreement with the findings of Kasier [32]. And the higher prevalence of tick infestation in zebu 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 zebu breed cattle are kept under extensive farming system. Therefore, the chance of occurrence in zebu breed cattle is greater than cross and borena breeds. The existing of great variation between zebu and borena breeds due to much more number of zebu cattle were come to the clinic samples were taken during collection.

In this study, there was a significant difference between body conditions, ($P= 0.001$). The occurrence of tick infestation in three different body condition (Poor, medium and good) of animals shows the highest prevalence in medium body conditions (41.8%), followed by good body conditions (29.2%) and (14.2%) in poor body condition. Odd ratio indicated that, Good body condition animal less (OR=0.293, P=0.015) likely affected by tick than poor body condition animal and medium body condition animal (OR=0.358, P=0.001).

Recommendations: The study indicated that there was high burden of ticks in the study area that almost all sampled animals can have ticks on their body. However, the attention given to control the infestation had not been sufficient and only Acaricide application is the main method of tick control in the region.

Tick should be managed at an economically acceptable level by a combination of techniques and this requires knowledge of the tick species prevalence and an understanding of their epidemiology. Because there is no single method that would guarantee complete control of ticks and tick borne diseases, combination of available methods of tick control is necessary. This encompasses the selection of tick resistant cattle, acaricide treatment, appropriate livestock management, evaluation and incorporation of traditional practices or remedies that appear to be of value.

Therefore, Strategic tick control, application of acaricides aimed at reduction of ticks' population based on information about their seasonal activity, which is treating animals two to three times at early rainy season and about two treatments later around the end of rainy period to reduce next tick generation.

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