

Study on the status of bovine tick infestation, in Guba-koricha District in West Hararghe zone, east - Ethiopia

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Abstract

A cross-sectional study was conducted from November 2010 to April 2011 to determining the prevalence of tick infestation, to identify the common tick species in cattle and to assess the major risk factors associated with the occurrence of tick species in Gubakorichadistrict WestHararghe zone of Oromia regional state, southeast Ethiopia. Ticks were collected by searching and half body of animals using forceps on different regions of the animals' body. A total sample of 384 cattle, 234 were found to be infested by one or more tick species an overall prevalence of 60.9%. The most predominant isolated ticks species in this study were *R. pullchelus* with isolation rate of 49.4% followed *A. Varigatum* with isolation rate of 30.3%, *H. marginatumrufipes*, the third predominant with isolation rate 11.8%. However, *A. gemma*, *H. trucatum* and *R. Evertsi-evertsi* was the least isolate which accounts for 3.6%, 2.4% and 2.35% respectively. Age, sex and body conditions scoring were found to be important risk factors associated with tick infestation. The prevalence of tick infestation between age and sex was statistically significant ($X^2=32.3075$, $CI=0.1323358-0.265075$, $P=0.000$ and $X^2=5.117$, $CI=0.1953184-0.0061713$, $P=0.037$) respectively. However, breed and body condition were not statistically significant ($P>0.05$). Hereof, Ticks are obligate, blood feeding ecto-parasites that cause severe damage to the hides and skins of domestic cattle due to this reduce the foreign exchange of the country; and also transmit tick borne diseases. Therefore, effective tick control programs should be formulated and implemented at national or regional level.

Key word: -control program, prevalence and tick.

1. Introduction

Ethiopia, located in the horn of Africa, it has an extremely diverse topography; a wide range of climatic features and multitudes of agro-ecological zonation which makes the country suitable for different agricultural production for 85-90 % of the people of Ethiopia is agriculture (CSA, 2004). Ethiopia is endowed with the largest livestock population in Africa. Therefore, livestock play a vital role in the farming system of the country mainly used for draught power, milk and meat production and source of manure. Unfortunately, the contribution of this huge natural resource to human nutrition and export earnings is disproportionately low. The Ethiopian livestock contributes only 15 % to the GDP. Total herd meat off-take is estimated at around 7 % annually, which is perhaps one-third lower than the average for tropical Africa. Cattle are a prime resource for the people and government of Ethiopia. The country has the largest cattle population in Africa, estimated at 35 million head (CSA, 2002).

Ticks are obligate, blood feeding ecto-parasites of vertebrates, particularly mammals and birds. It has been estimated that about 80% of the world population of cattle are infested with ticks. The lifecycle of ticks (both Ixodids and Argasids) undergo four stages in their development; eggs, 6-legged larva, 8-legged nymph and adult (Minjauw and McLeod, 2003). Based on the number of hosts required to complete their development during their life cycle they can be classified as one-host, two-host and three-host ticks (Walker, *et al.*, 2003). Although, only relatively few of more than 889 species of tick in the world are important to man and his domestic animals, these few species must be controlled if livestock production is to meet world needs for animal protein (Drummond, 2007). Over 79 different species are found in eastern Africa but many of these appear to be of little or no economic importance (Cumming, 1999). But out of over 79 ticks species in Ethiopia, there are 47 species of ticks found on livestock and most of them have importance as vector and disease causing agents and also have damaging effect on skin and hide production (Kassa, 2005) and also they down grade hide and skins quality and reduce milk and wool production, reduce productivity and increase susceptibility to the other diseases (De Castro, 1997). Ticks also have adverse effect on livestock in several ways and parasitize a wide range of

vertebrate hosts and transmit a wide variety of pathogenic agents than any other group of arthropods (Oliver, 1989).

They transmit protozoa, bacterial, rickettsia and viral diseases in domestic animals. They also cause nonspecific symptoms like anemia, dermatosis, toxicosis and paralysis (Solomon, *et al.*, 2001).

In Ethiopia ticks are common in all agro-ecological zones of the country (Pegram, *et al.*, 1981). Therefore, relevant data on the distribution of ticks is essential for the development of effective tick and tick-borne disease control strategies. Studying ticks on livestock under their natural conditions without any control measure is also useful for understanding the host-parasite relationship and variation of tick population in different agro-ecological zones. 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 Nekemte (Belete, 1987), Hararghe (Guliat, 1987), Asella Behailu Assefa (2004), Awassa (Mehari, 2004), Mizan Teferi (Seid, 2004) and Jimma (Yitbarek, 2004), with the highest prevalence rate as well as *Rhipicephalus* is also a predominant genera and has been reported with the highest prevalence in Gamo Gofa (Jewaro, 1986), Bale (Dejenu, 1988) and Southern Sidamo (Sebsibe, 1988). *Boophilus* and *Hyalomma* ticks also have a significant role.

The populations of ticks are influenced by climatic changes, which affect the rate of tick population on the ground, host resistance and natural enemies Solomon Gebre *et al.*, (2001).

Amblyomma cohaerence is prevalent and abundant in western humid highland areas of Ethiopia.

Boophilus decoloratus and *Rhipicephalus evertsi evertsi* are widely distributed in most altitudinal ranges Bekele Hailu (1987). Therefore, this study was designed with the aims of

- ✓ To determine the prevalence of tick infestation of cattle in the study district.
- ✓ To identify the common tick species in Gubakoricha district.
- ✓ To assess the major risk factors associated with the occurrence of tick species in the study area.

[2].

2. Materials and method

2.1. Study area

The study was conducted in GubaKoricha is one of the District located in the West Hararghe Zone in the Oromia Region of Ethiopia, according to the OCHA map (2005) is bordered on the south by Darolebu, on the southwest by the Arsi Zone, on the west by the Afar Region, on the north by Mieso, on the northeast by Chiro, on the east by Habro, and on the southeast by Boke. Although coffee is an important cash crop of this District, less than 20 square kilometers are planted with this crop. The altitude of the study area ranges from 1300 to 2800 meters above sea level while the minimum annually temperature ranges between 22^oC and 28^oC. The mean annually rain fall of the area ranges from about 1050 to 2160 mm.

The 1994 national census reported total populations for this Districts were 139, 198, of whom 71,625 were men and 67,573 women; 3,930 or 2.82% of its population were urban dwellers at the time. The three largest ethnic groups reported in Gubakoricha were the Oromo (81.52%), the Amhara (11.86%) and the Argobba (6.16%); all other ethnic groups made up 0.46% of the population. Oromiffa was spoken as a first language by 80.49%, and 19.06% spoke Amharic; the remaining 0.45% spoke all other primary languages reported. The majority of the inhabitants were Muslim; with 86.11% of the population reporting they practiced that belief, while 12.02% of the population said they professed Ethiopian Orthodox Christianity and 1.8% was Catholic.

2.2. Study population

According to Gubakoricha district Agricultural Bureau (2009), the live stock population of Gubakoricha generally, about 219,593 live stocks, out of this 83,168 are cattle and the rest are other species of animals. The study populations were constituted in all breeds but the mostly populated breed in the area was indigenous or local breeds kept under mixed farming system and People of

the district are directly depending on livestock and agricultural production to boost the quality and quantity of this product.

2.3. Study Design

A cross-sectional study was conducted from November 2010 to April 2011 to determine the prevalence of tick infestation, to identify the common tick species in cattle and to assess the major risk factors associated with the occurrence of tick species in Gubakoricha district West Hararghe zone of Oromia regional state.

2.4. Sampling and Sample Size Determination

For estimation of the prevalence of ticks, since there was no work done in the study area, the cattle to be examined were selected by simple random sampling method, and the sample size was determined by assuming of using the formula described by Thrusfield (2005). The expected prevalence of Ixodidae ticks of cattle in Gubakoricha District was assumed as 50%. The parameters used were 95% confidence interval and 5% desired level of precision. By substituting these values in the formula, the sample size taken was $n = 384$

$$N = \frac{1.96^2 P_{exp} (1 - P_{exp})}{D^2}$$

2.5. Study Methodology

2.5.1. Sampling procedure and techniques

Ticks were successfully collected from cattle after being restrained using strong crushes, by physical handling. Ticks were collected by searching and half body of animals using forceps on different regions of the animals' body. Ticks were collected from ears, heads, dewlaps, belly/flank, udder/scrotum, perineum and legs/tails in the separated sample bottles. 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 Hirna regional veterinary laboratory for the 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). First ticks were seen grossly and classified to different genera levels and identified into their species level depending up on their morphological structures.

During tick identification in the laboratory the sample were put on Petridis and examined under stereomicroscope.

2.6. Methods of Data Management and Statistical Analysis

The data collected during sampling and laboratory findings were entered and stored in MS-excel. Before subjected to statistical analysis, the data were thoroughly screened for errors and properly coded. An intercooled Stata 9 software package (Stata Corporation, 2005) was used to perform the statistical analysis. Descriptive statistical analysis such as table was used to summarize and present the data collected. Ticks prevalence was calculated as percentage by dividing the number of animals positive to the total sampled animals. Pearson chi-square (χ^2) test was employed to assess the existence of association between tick infested cattle's and different potential risk factors considered in the study. For this analysis P-value <0.05 were considered significant whereas P-value >0.05 considered non-significant.

3. Results

3.1. Prevalence of ticks on cattle in Gubakoricha district

Out of the total sample of 384 cattle, 234 were found to be infested by one or more tick species an overall prevalence of 60.9%. A total 1572 Ixodid ticks were collected among which three genera of ticks were identified. *Rhipicephalus* was the most abundant (51.8%) genus and *Hyalomma* was confirmed to be the least prevalent (14.25%) tick genus (Table 1).

Table 1: Distribution of tick genera in Gubakoricha district .

Genus	Percentage of total tick genera
Rhipicephalus	51.8% (814/1572)
Amblyomma	33.96% (534/1572)
Hyalomma	14.25% (224/1572)

The results of tick identification from infested cattle's revealed that involvements of 1572 Ixodid ticks were collected among which three genera and six species of ticks were identified. Therefore, the most predominant isolated ticks species in this study were *R. pullchelus* with isolation rate of 49.4% followed *A. Varigatum* with isolation rate of 30.3%, *H. marginatum rufipes*, the third predominant with isolation rate 11.8%. However, *A. gemma*, *H. tructatum* and *R. Evertsi-evertsi* was the least isolate which accounts for 3.6%, 2.4% and 2.35% respectively. The tick identification rate and their prevalence are shown on (Table 2).

Table 2: Results isolation of tick's species in cattle's.

Tick species	Total count and prevalence (%)
<i>R. Pullchelus</i>	(49.4%) 777
<i>A. Varigatum</i>	(30.3%) 477
<i>A. gemma</i>	(3.6%) 57
<i>R. Evertsi</i>	(2.35%) 37
<i>H. truncatum</i>	(2.4%) 38
<i>H. marginatumrufipes</i>	(11.8%) 186

During the study period, each species of ticks were collected from various favorable bodies of cattle's and also we are collecting multi species ticks on some attachment site. The observed proportion of attachment sites for each species of the ticks during this study was summarized in table 3.

Table 3: Favorable attachment sites of tick's species.

Species of ticks	Site of attachment
<i>Amblyomma species</i>	Brisket, udder, scrotum and dewlap
<i>Rhipicepahlus species</i>	Tail, head, ear and angonetial
<i>Hyalomma species</i>	Scrotum, udder and brisket

During the study time, we are revealing that sex ratio of adult ticks in the study area, the number of Male tick's species higher than female tick's species in *R. Pullchelus*, *A. Varigatum*, *R. Evertsi*-

evertsi, *H. truncatum* and *H. marginatumrufipes* but in the case of *A. gemma* tick species the number of female ticks species higher than male ticks species (Table 4).

Table 4: Distribution and sex ratio of adult tick species

Tick species	Male	Female	M:F ratio	Total	Prevalence
R. Pullchelus	580	197	2.94:1	777	49.4%
A. Varigatum	365	112	3.26:1	477	30.3%
A. gemma	9	48	1:5.3	57	3.6%
R. Evertis	37	-	0	37	2.35%
H. truncatum	38	-	0	38	2.4%
H. marginatumrufipes	148	38	3.9:1	186	11.8%

From three genera and six species identified in the study area and their relative infestation rate of *R. Pullchelus* (33.8%), *A. Varigatum* (21.8%) and *H. marginatumrufipes* (15.38%) were more prevalent on the animals of current study. However, *A. gemma* (8.97%), Multi species (8.12%), *R. Evertsi-evertsi* (7.26%) and *H. truncatum* (4.7%) were the least tick species found on the body of the animals respectively (Table 5).

Table 5: Distribution of tick species on the animal

Ticks species	Total animals examined N= 234	
	Positive animals	Prevalence
R. Pullchelus	79	33.8%
A. Varigatum	51	21.8%
A. gemma	21	8.97%

R. Evertis	17	7.26%
H. truncatum	11	4.7%
H. marginatumrufipes	36	15.38%
Multi species	19	8.12%

In this study, different possible risk factors like age, sex, breed and body condition scoring were also assessed and the result was as indicated here in table 6. **Age:** one of a possible risk factor for the occurrence ticks infestation, hereof among the three age categories the highest ticks infestation prevalence was recorded in old age (75.14%) followed by adult age (66%) and lower on young age (35.85%) (Table 6). However, there is statistical ($p < 0.005$) significant between infestation of tick and age groups ($X^2=32.3075$, $CI=0.1323358-0265075$, $P=0.000$).

Sex: comparison was made on the prevalence of female and male. Out of animals sampled, the majority or 54.4% were females while about 45.6% of them were males. The tick prevalence was 63.6 % and 57.3 % in female and male respectively (Table 6). However, there is statistical ($p < 0.05$) significance between the two sexes ($X^2=5.117$, $CI=0.1953184-0.0061713$, $P=0.037$).

Breed: As indicated in the (Table 6) below, the study revealed that the prevalence of tick infestation in Local breeds was that 63.03% recorded and the prevalence of tick infestation in Cross breed were found to be 33.03 %. There is no significant difference ($P > 0.05$) in the prevalence of tick infestation among the two breeds of animals during our survey ($X^2=0.4005$, $CI=0.1301061-0.2381844$, $P=0.564$).

Body condition score: were also considered during examination, animals were divided into three body condition scores as shown in the (table 6). These are, good, medium and poor. Out of 384 animals examined 75 animals were poor body condition state and out of these 65 (86.7%) animals were positive for tick infestation, therefore, high prevalence of ticks infestation was recorded in poor body condition followed by 198 animals were in medium body condition and out of these 124 (62.6%) animals were positive for tick infestation, and the rest 111 animals were in good body condition, out of these 45 (40.5%) animals were positive for tick infestation. These

result shows that body condition scoring have no significant ($p > 0.005$) relation with tick infestation ($X^2=0.8116$, $CI=0.039221-0.0968792$, $P=0.405$).

Table 6: Ticks infestation with regard to potential risk factors

Variables	Classification	No of sample	No of positive	Infestation Prevalence	Significance
Age	Young	53	19	35.85%	$X^2= 32.3075$ $P= 0.0000$
	Adult	150	79	66%	
	Old	181	136	75.14%	
Sex	Male	175	101	57.7%	$X^2= 5.3117$ $P= 0.037$
	Female	209	133	63.6%	
Breed	Local	357	225	63.03%	$X^2=0.4005$ $P=0.564$
	Cross	27	9	33.3%	
BCS	Poor	75	65	86.7%	$X^2= 0.8116$ $P= 0.405$
	Medium	198	124	62.6%	
	Good	111	45	40.5%	

4. Discussion

The distribution and abundance of tick species infesting domestic ruminants in Ethiopia vary greatly from one area to another area. The study was carried out to determine the prevalence of tick infestation in cattle, to assess the major risk factors in the study areas. From the total of 384 local and cross breed cattle, the overall prevalence recorded was 60.9%. It is disagree from the findings of Nigatu and Teshome, who reported an overall prevalence of (89.4%). However, it is higher than the findings of Belew and Mekonnen 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 (Pegram, *et al.*, 1981).

From infested cattle's three genera of hard ticks were identified, namely *Rhipicephalus* (51.8%), *Amblyomma* (33.96%) and *Hyalomma* (14.25%) and 1572 Ixodid ticks were collected from six species of ticks. Therefore, the predominant isolated tick's species were *R. pullchelus* with isolation rate of 49.4%, followed *A. Varigatum* with isolation rate of 30.3%, *H. marginatum rufipes*, the third predominant with isolation rate 11.8%. However, *A. gemma*, *H. truncatum* and *R. Evertsi-evertsi* was the least isolate which accounts for 3.6%, 2.4% and 2.35% respectively, were identified in the study area.

R. Pullchelus, was the most abundant of all tick species comprising (49.4%), of the collected ticks in the study areas. This finding was disagree, with the results have been reported by Solomon *et al* (1998). It was collected from different part of Ethiopia in eastern Tigray, southern SNNP, Afar, Harar, Somalia and Dire Diwa.

Followed by *R. Pullchelus* the most abundant tick's species in the study area was *A. Variegatum* 30.3%. This results was agree with the results have been reported by TesfaneshGebremichael (1993) in North Omo, and MehariBirhaneinAwassa (2004). And this could be due to the fact that *A. variegatum* is the most common and widely distributed cattle tick in Ethiopia (Morel, 1980, Pegram, *et al* 1981).

It has a great economic importance, because it is an efficient vector of *Cowderiaruminatum* and greatest damage to skin and hide, due to its long mouth parts, so it will reduce the value on world market (Solomon, *et al.*, 2001). Also, ulcer caused by this tick species becomes favorable site for secondary bacterial infection like *Dermatophilus congolensis*.

H. marginatum rufipes was identified as the 3rd abundant ticks species collected in the study area. This tick's species was collected restricted area of the warm, moderately dry midland with an altitude of 1800 to 1950 (Morel, 1980). Belew and Makonen (2010) indicate that widely distribute in the most arid topical parts of Africa and in Ethiopia most often collected between 1000 and 2000 m.a.s.l and rare in western highland of areas. Therefore the finding of Belew and Makonen (2010) was agreed with the present study. The study of Mohammad (1985) in Wolayitaawraja and siyoum (2001) in north wollo zone kobo girana valley and Solomon (1996) at Abernosa ranch are in agreement with the present finding.

A. gemma was the 4th abundant tick species collected and represent (3.6%) of the total collection. This tick species was collected from restricted area of arid, semi-arid and rift valley restricted to semi-arid plain and bush land receiving 100 to 800 mm rainfall annually (Morel, 1980). Morel (1980) stated that *A. gemma* widely distributed in woodland, bush land, wooded and grassland in arid and semiarid area between altitude 500 to 1750 m above sea level and receiving 350 to 750 mm annual rain fall.

H. truncatum is the least abundant tick species constituting 2.4% of the total of adult tick collection in the study area. This results was disagree with the results have been reported by Regassaa (2001) in Borena this due to the agro ecological condition which is low land and receive small rainfall but in our study areas altitude factors which govern the distribution of ticks in the study area. In sub

shara Africa, *H. truncatum* is very wide spread and often common. Its abundance may be influenced by the abundance of hosts that are preferred hosts of the mature stages (Walker, *et al.*, 2003).

R. evertsi is the least abundant tick species constituting 2.35% of the total of adult tick collection in the study area. In contrast to this study this tick species was reported to be prevalent by other authors such as Mesele in Bahirdar (1989), Behailu, 2004 and Morel, (1980) mentioned that the native distribution of *R. evertsi* in Ethiopia seems to be connected with middle highland, dry savannas and steppes in association with zebra and ruminant.

The geographical distribution of survey of ticks conducted in Gonderawraj by Eshatu (1988) found that *R. evertsi* was the most abundant tick species of the area. This may be due to the geographic location, seasonal variation of the area or may be due to variation in microclimate factors (Singhet *et al.*, 2000) including higher rainfall associated with high soil moisture content which is favorable on the survival of tick vectors. This tick shows no apparent preference for any particular altitude rainfall or season (Pegram, *et al.*, 1981).

The present study also revealed that ticks select favorable sites for their attachments on the body of cattle, Howell *et al.*, (1978) in South Africa who reported that similar favorable sites of ticks to attach themselves on the cattle's body. Information on predilection sites of ticks is helpful in spraying individual animals since it gives a clue as to which part of the body requires more attention (Pegram *et al.*, 1981).

The male to female ratios of all tick species except in the case of *A. gemma* ticks species the number of female ticks species higher than male ticks species. The male to female ratios of *R. Pullchelus*, *A. Varigatum*, *H. marginatum rufipes*, *A. gemma*, *H. truncatum* and *R. Evertsi* were similar to previous reports Seyoum, Zenebe (2001); Solomon Gebre, *et al.*, (2001). Except the females of *A. gemma* outnumbered than males in this study probably due to small size of male which may, all other species of ticks suggesting that male outnumber that the female ticks could be the fact that 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.*, (2001).

During the study period, the prevalence of tick infestation was assessed between three age group cattle. The adult and old are more sustainable than young due to the fact that the young are not often driven with adult and old age group into grazing and water points. This practice naturally reduces the chance exposure of young cattle to ticks.

During the study period, the prevalence of tick infestation was assessed between sex of animals higher prevalence was recorded in female animals (63.6%) compared to male (57.7%). This variation may be associated with male animals which were kept properly in the house with good management system for beef purpose whereas, female animals grazing on field all day may be exposed to tick infestation. In current study there is significant association of tick infestation between sexes of animal. This finding disagrees with Endale, (2006).

The study also revealed that the prevalence of tick infestation was assessed between local and cross breeds was recorded 63.03% and 33.03 % respectively. The fact that more tick burden was recorded in local breed as compared to cross breed animals this due to differences in management systems, lack of supplementary feeding to local cattle breeds, or lack of control measures against ticks on local cattle breeds. Furthermore, it can be assumed that it might be due to lack of interest of farmers about local cattle and taking more care to cross breed. In current study there is no significant association of tick infestation between two breeds of animal ($X^2=0.4005$, $CI=0.1301061-0.2381844$, $P=0.564$).

4. Conclusion and recommendation

Ticks are obligate blood feeding ectoparasites of vertebrates, among ecto-parasite it cause the greatest economic loss in livestock population either by transmitting a wide variety of TBDs or by affecting the health of animals as well as the quality of hide and skins. In this study an overall

prevalence of tick infestation 60.9% were obtained by using half body count and stereomicroscope. The main tick genera found in Ethiopia are *Amblyomma*, *Boophilus*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. From this genus, the most important and abundant tick species investigated in the study area were *R. Pullchelus*, *A. Varigatum*, *A. gemma*, *R. Evertis*, *H. truncatum*, and *H. marginatum rufipes*. Among the possible risk factors considered in this study; age, sex, breed and body condition scoring. Whereas age and sex have significant association with infestation of tick. Furthermore, predilection sites are identified that helps in designing control methods and which parts of the cattle's body to be covered while using ectoparasiticide chemicals. Therefore, to minimize the impact effective tick control program should be formulated and implemented at national and regional level based on the distribution pattern of ticks and factors responsible for their distribution. In light of the above conclusion the following recommendations are forwarded:-

- ✓ Tick should be managed at an economical acceptable level by a combination of techniques and this requires familiarities with the tick species present and an understanding of their epidemiology for the continuous understanding of improved control strategies.
- ✓ Awareness creation for farmers and extension agents to accept the benefits gained from both boosting immunity to TBD and achieving host resistance to ticks that would result from relaxed tick control regimes.
- ✓ Adjust animal husbandry practice based on defense reaction of the animal against tick.
- ✓ A strong veterinary service structure has to be established to strengthen tick surveillance network at national level, co-ordinate data collection, implement appropriate control and preventive measures.

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