



Science

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 Guba koricha district West Hararghe 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. 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. 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 ($X^2=32.3075$, $CI=0.1323358-0265075$, $P=0.000$ 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 transmit tick borne diseases. Therefore, effective tick control programs should be formulated and implemented at national or regional level.

Keywords: Control Program; Guba Koricha; Prevalence And Tick.

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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 **Error! Reference source not found.** 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 dis-proportionally 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 **Error! Reference source not found.**

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 **Error! Reference source not found.** 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 **Error! Reference source not found.** 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 **Error! Reference source not found.** Over 79 different species are found in eastern Africa but many of these appear to be of little or no economic importance **Error! Reference source not found.** 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 **Error! Reference source not found.** and also they down grade hide and skins quality and reduce milk and wool production, reduce productivity and increase susceptibility to the other diseases [**Error! Reference source not found.**]. 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 **Error! Reference source not found.** They transmit protozoa, bacterial, rickettsia and viral diseases in domestic animals. They also cause nonspecific symptom like anemia, dermatosis, toxicities and paralysis **Error! Reference source not found.** In Ethiopia ticks are common in all agro ecological zones of the country **Error! Reference source not found.** 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 zone.

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 **Error! Reference source not found.**, Hararghe **Error! Reference source not found.**, Asella **Error! Reference source not found.**, Awass **Error! Reference source not found.**, Mizan Teferi **Error! Reference source not found.** and Jimma **Error! Reference source not found.** with highest prevalence rate as well as *Rhipicephalus* is also predominant genera and has been reported with highest prevalence in GamoGofa **Error! Reference source not found.**, Bale **Error! Reference source not found.** and Southern Sidamo **Error! Reference source not found.** *Boophilus* and *Hyalomma* ticks also have a significant role. The populations of tick are influenced by climatic changes, which affect the rate of tick population on the ground, host resistance and natural enemies **Error! Reference source not found.** *Amblyomma coherence* is prevalent and abundant in western humid highland areas of Ethiopia. *Boophilus decoloratus* and *Rhipicephalus evertsi evertsi* are widely distributed in most altitudinal ranges **Error! Reference source not found.** Therefore, this study was designed with the aims of

- To determining 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 ticks species in the study area.

2. Materials and Method

2.1. Study Area

The study was conducted in Guba Koricha 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 22⁰C and 28⁰C. The mean annually rain fall of the area ranges from about 1050 to 2160 mm.

2.2. Study Population

According to **Error! Reference source not found.** **Error! Reference source not found.** **Error! Reference source not found.** the live stocks population of Guba koricha 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 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's species in Guba koricha 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 **Error! Reference source not found.** The expected prevalence of Ixodidae ticks of cattle in Guba koricha 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/flunk, 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 **Error! Reference source not found.** First ticks were seen grossly, 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 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 Guba Koricha 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 Guba koricha 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. 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. 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. trucatum</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>Ambylomma species</i>	Brisket, udder, scrotum and dewlap
<i>Rhipicepahlus species</i>	Tail, head, ear and angonetial

<i>Hyalomma species</i>	Scrotum, udder and brisket
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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. marginatum rufipes* (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 out 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 **Error! Reference source not found.** 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 **Error! Reference source not found.** 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. Varigatum* 30.3%. This results was agree with the results have been reported by **Error! Reference source not found.** in North Omo, and in awasa **Error! Reference source not found.** In addition, this could be because *A. variegatum* is the most common and widely distributed cattle tick in Ethiopia **Error! Reference source not found.**

It has a great economic importance, because it is an efficient vector of *Cowderyia ruminatum* and greatest damage to skin and hide, due to its long mouth parts, so it will reduce the value on world market **Error! Reference source not found.** 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 (**Error! Reference source not found.**). **Error! Reference source not found.** 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 **Error! Reference source not found.** was agreed with the present study. The study **Error! Reference source not found.** in Wolayita awraja and **Error! Reference source not found.** in north wollo zone kobo girana valley and **Error! Reference source not found.** 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 **Error! Reference source not found.**, **Error! Reference source not found.** 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 **Error! Reference source not found.** 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 widespread and

often common. Its abundance may be influenced by the abundance of hares that are preferred hosts of the mature stages **Error! Reference source not found.**

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 **Error! Reference source not found.** 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 tick has conducted in Gonder awraj **Error! Reference source not found.** 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 **Error! Reference source not found.** including higher rainfall associated with high soil moisture content that is favorable on the survival of tick vectors. This tick shows no apparent preference for any particular altitude rainfall or season **Error! Reference source not found.**

The present study also revealed that ticks select favorable sites for their attachments on the body of cattle **Error! Reference source not found.** 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 **Error! Reference source not found.**

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. Everts* were similar to previous reports **Error! Reference source not found.** 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 **Error! Reference source not found.**

During the study period, the prevalence of tick infestation was assessed between three age groups of cattle. The adult and old are more sustainable than young because the young are not often driven with adult and old age group into grazing and water points. This practice naturally reduces the chance of 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 **Error! Reference source not found.**

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 compare 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 tick 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 breed of animal ($X^2=0.4005$, $CI=0.1301061-0.2381844$, $P=0.564$)

5. 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 identifies 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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References

- [1] Behailu, A. (2004). A study of ticks and tick-borne protozoans in cattle at Assela, Arsi Zone (DVM thesis). FVM, Addis Ababa University, DebreZeit, Ethiopia.

- [2] Belete, M. (1987). A preliminary survey of ticks on four domestic animals in Nekmet Awarja. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeite, Ethiopia.
- [3] Belew, T. & A. Mekonnen, (2011). Distribution of Ixodid Ticks on Cattle in and Around Holeta Town Ethiopia. CAVM, JU, Ethiopia. *Global Veterinaria*, 7(6): Pp.527-531.
- [4] Bekele, H. (1987). Study of the topographical distribution of tick on economically important
- [5] Domestic animals in Illubabor. DVM thesis, FVM, Addia Ababa University, Debrezeit, Ethiopia.
- [6] Central Statistics Authority CSA. (2002): Ethiopian statistical abstract. Addis Ababa, Ethiopia.
- [7] Central Statistics Authority CSA. (2004). Ethiopia agricultural sample enumeration result for SNNPR. Statistical report on livestock and farm implements. Part IV: Pp.29-304.
- [8] Cumming, G.S., (1999). Host distributions do not limit the species ranges of most African ticks (Acari: Ixodida) *Bulletin of Entomological Research* (1999), 89: Pp.303-327.
- [9] De Castro, J. (1997). Sustainable ticks and tick-borne disease control in livestock improvement in developing countries. *Vet. Parasitology*. 71: Pp.69-76.
- [10] Dejen, G. (1988). A preliminary survey on tick on. (Acari: Ixodida). *Annu. Rev. Ecol. Syst.*, 20: Pp. 396-430.
- [11] Drummond, R.O. (2007). Tick borne livestock diseases and their vector. *World Animal*
- [12] *Review* 3.htm
- [13] Endale, B., (2006). A survey on tick of cattle in Ambo area, western Ethiopia (DVM thesis), Addis Ababa .University, Ethiopia. (Under publish).
- [14] Eshetu, M. (1988). Survey of geographic distribution of ticks in Gonderawraja. DVM Thesis, faculty of veterinary medicine, Dberezeit, Ethiopia.
- [15] Gubakoricha District Agricultural Beruea, (2009).
- [16] Gulilat, A., (1987). A preliminary survey of ticks on domestic animals in Harraghe Administrative region. DVM thesis, faculty of veterinary medicine, Addis Ababa University, Debrezeit, Ethiopia.
- [17] Howell, CJ, Walker, JB., & Nevil, EM (1978). Ticks, Mites and Insects infesting domestic animals in Republic of South Africa department of agricultural technical service. *Science bulletin of the department of agricultural technical service in Republic of South Africa*. Pp. 1-13.
- [18] Jewaro, A. (1986). A survey of tick and tick born disease in Gamogofa administrative region. DVM Thesis, faculty of veterinary medicine, Addis Ababa University, Debrezeit, Ethiopia.
- [19] Kassa, B. (2005). Standard veterinary laboratory diagnostic manual. Veterinary diagnostic laboratory, college of veterinary medicine at the University of Illinois at urbana, urbana.ILUSA.
- [20] Mehari, B. (2004). Distribution of livestock tick species in Awassa area. DVM Thesis, faculty of veterinary medicine, Addis Ababa University, Debrezeit, Ethiopia.
- [21] Mesele, A. (1989). Bovine tick survey in Bahir Dar Awraja. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debrezeit. Ethiopia.
- [22] 20. Minjauw, B., & McLeod, A. (2003). Tick borne diseases and poverty. The impact of ticks and tick borne diseases on livestock owners in India and Eastern health program center for tropical veterinary medicine, University of Edinburgh, UK. Pp. 24-57.
- [23] Mohamed, B., Belay, A & Hailu, D. (1997). Species composition, prevalence and seasonal variations of ixodid cattle ticks in and around Haromaya town. *Academic journal. CAVM, JU, Ethiopia*. Pp. 132-137.
- [24] Morel, P. (1980). Study on Ethiopian ticks (Acaridae: Ixodidae). 1st.Ed. Republic of France, Ministry of Foreign affairs, French Vet. Mission, Addis Ababa, Ethiopia Pp. 15-183.
- [25] Nigatu, K., & F. Teshome. (2012). Population Dynamics of ectoparasite in Western Amhara National Regional States, Ethiopia, *Journal of Vet. Med. And Animal Health*, 4(1): Pp.22-26.
- [26] Oliver, J. (1989). Biology and systematics of ticks (Acari: Ixodida). *Annu. Rev. Ecol. Syst.*, 20(1): Pp. 397-430.

- [27] Pegram, R., H. Hogstral, H., & Wassef. (1981). Ticks (Acari: Ixodoidea) of Ethiopia. I. Distribution, ecology and host relationship of species infesting livestock. Bull. Of Intomol. Res., 71: Pp. 339-359.
- [28] Regassa, A. (2001) Tick Infestation of Borana Cattle in the Borana Province of Ethiopia. Onderstepoort Journal of Veterinary Research, 68, Pp. 41-45.
- [29] Sebsibe, B. (1988); A preliminary survey of tick distribution in Southern Sidamo, DVM Thesis, FVM, AAU, DebreZeit, Ethiopia.
- [30] Seid, B. (2004). A survey of cattle tick species in and around Mizan- Teferi, Bench Maji zone and SNNPRS. DVM Thesis, AAU, FVM, DebreZeit, Ethiopia.
- [31] Singh, AP., Singla, LD., & Singh, A. (2000). A study on the effect of microclimate factors on the seasonal population of dynamics of Boophilus micopus (Canes, 1888) infesting the cross bred cattle of Ludhiana district. Int. j. Anim. Sci. 15(1): Pp. 29-31.
- [32] Siyoum, Z. (2001). Study on tick and tick borne disease on cattle at Girran valley in the North WolloZone, proceeding of Ethiopia veterinary association. Pp: 15.
- [33] Solomon, G., & Kaaya, G. (1996). Studies on the developmental and survival of Rhipicephaluspulchelu and Amblyoma gemma under field condition. Ethiopia Vet.Assoc.
- [34] Solomon, G., Kaaya, G., Feseha, G., & Getachew, T. (1998). Ticks and tick borne parasites associated with indigenous cattle in Dituyura ranch, southern Ethiopia insect science and its application.
- [35] Solomon, G., & Kassa, G. (2001). Development reproductive capacity and survival of Amblyomma variegartum and Boophilus decoloratus in relation host resistance and climatic factors under different field conditions. Vet. Prasitol., 75: Pp.241-253.
- [36] Solomon, G., Night, M., & Kaaya, GP. (2001). Seasonal variation of ticks on calves at Sabetha, Western Shewa zone. Ethiopia Vet. J. 7(1&2): Pp.17-30.
- [37] Stata Corporation. (2005). Stata Statistical Software .Release 9.0. College Station, Texas.
- [38] Tesfanesh, G. (1993). Tick and tick borne diseases of cattle in North Omo administrative Zone, DVM thesis, Faculty of veterinary medicine, Addis Ababa University, Debrezeit, Ethiopia, Pp: 1-50.
- [39] Thrusfield, M. (2005). Veterinary epidemiology, 3rd edition. Blackwell science.Ltd. Oxford. Pp. 232-234.
- [40] Walker, R., A. Butiur, S., Estrada-pen, A., Hora G., Latif, A., Pergam & Preston, P. (2003). Tick of domestic animal in Africa, Guide to Identification Tick Species, Pp: 3-210.
- [41] Yitbarek, G. (2004). Tick species infesting livestock in Jimma, Southern Western Ethiopia, DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeite, Ethiopia.

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