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Prevalence and Identification of Ixodid ticks on Cattle In and Around Hawassa town, Southern Ethiopia

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Abstract

A cross sectional study was conducted from November, 2019 to May, 2020 in Hawassa town, Southern Ethiopia, with the objective of identifying major tick species and determining their prevalence in cattle. A total of 384 cattle under extensive semi-extensive management systems were examined on random basis throughout the study period, out of which 296 (77.1%) cattle were found to be infested by tick. About 780 adult ticks were collected from the animals and two tick species were identified. On the basis of morphological characteristics, the identified ticks are *Amblyomma variegatum* (43.2%) and *Rhipicephalus evertsi evertsi* (33.9%). Except in different age groups and in different breeds of animals, there were no statistically significant variations ($P<0.05$) in the tick prevalence. From the two breeds of the study animals, the highest prevalence was in local breeds (74%) and the next was in exotic breeds (3.1%). A higher prevalence was observed in male cattle (42.4%) than females (34.7%). Age wise, prevalence was 32.5% in 1-2 years old, 22.2% in 3-7 years old and 22.4% in greater than 8 years old cattle. With regard to the prevalence of those ticks based on body condition of the animals, it was 33.7% in poor body condition, 40.1% in medium body condition and 3.3% in good body condition. The higher prevalence of ticks was observed in animals under extensive management system (42.2%) than semi-extensive management system (34.7%). Overall, the present study revealed very high prevalence of tick infestation that could potentially hamper the productivity of cattle in the study area. Therefore, a serious measure should be put in place to control and reduce the adverse effect of tick infestation.

Keywords: Cattle, Hawassa, Prevalence, Tick Species.

Introduction

Ethiopia, located in the horn of Africa, between latitude of 30 to 15^{o}N of the equator and longitude 33 to 48^{o}E, is an agrarian country with an estimated total land area of 1,101,000 km^{2}.The country has an extremely diverse topography, a wide range of climatic features and multitudes of agro ecological zone, which makes the country suitable for different agricultural production system. This in turn has contributed to the existence of large diversity of farm animal genetic resources. It has the largest number of livestock in Africa, approximately 53.99 million cattle, 25.5 million sheep and 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, 50.38 million poultry and 5.21 million bee hives (CSA, 2008).

The proportion of total population in agricultural sector is 82.4%. The important components of the Ethiopian farming system, their contribution to food production, rural income and export earnings are far below the expected potential. This is because cattle production in Ethiopia is constrained by the compound effects of animal diseases, poor feeding and poor managements. Ticks are obligate, blood feeding ectoparasites 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. Over 79 different species are found in eastern Africa but many of these appear to be of little or no economic importance. 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 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).

Ixodid ticks are one of the most common and harmful blood sucking ectoparasite of cattle worldwide. They are responsible for a wide range of livestock health problems in several countries of the world. They reduce cattle productivity, milk yield and skin and hide quality and increase susceptibility to other disease. Approximately, 80% of cattle populations of the world are at risk of tick infestation and tick born diseases. In addition to sucking large volume of blood, ticks inject pathogens such as viruses, bacteria, protozoa and toxins into their host (FAO, 2004).

Tick and tick borne diseases are major constraints in the genetic improvement and up-grading of cattle breeds; especially European breeds are highly susceptible to the various tick and tick borne diseases. Thus, ticks are big constraint for efficient livestock production in most of the tropical sub-tropical areas of the world (Walker *et al*., 2003). Therefore, this study was designed with the aims of:

- To identify the common tick species in Hawassa district.
- To determining the prevalence of tick infestation of cattle in the study area.
- To assess the major risk factors associated with the occurrence of ticks species in the study area.

Materials and Methods

Study Area: This research was conducted at Hawassa town, Southern Ethiopia. It is located 273 Km South of Addis Ababa via Bishoftu and 588.5 Km far away from Nekemte. Geographically it is found between 7°3' latitude North and 38°28' longitude East. The altitude ranges 1708 meter above sea level, the annual rainfall of the town ranges between 800-1000mm and the temperature ranges between 20-27°C. The total livestock population of Hawassa is generally about 219,593, out of this, 83,168 are cattle and the rest are other species of animals (Sileshi, 2013).

Study Design and Study Animals: A cross-sectional study was conducted from November, 2019 to May, 2020 to identify major tick species and to determine their prevalence. The study population consists of cattle managed under extensive and semi-extensive management systems which constitute local and exotic breeds with different age groups, sex and body condition categories.

Sample Size Determination and Sampling Method: The examined cattle were selected by simple random sampling method and the sample size was determined by using the formula indicated by Thrusfield (2007), $N=1.96^2*Pexp\ (1-Pexp)/d^2$; where, N = required sample size; Pexp = expected prevalence; d = desired absolute precision. The expected prevalence of ticks of cattle in Hawassa town was assumed as 50%. The parameters that were used were 95% confidence interval and 5% desired level of precision. Therefore, by substituting these values in the formula, $N = 1.96^2*0.5(1-0.5)/\ (0.05)^2$ = 384 sample size of cattle were examined in the study, N = 384.

Study Methodology: The host related factors like age and body condition were classified into groups for the convenience of the study. The age of the cattle were grouped into young (1 to 2 year), adult (3 to 7 years) and old (>8 years) according to Gatenby (1991). While body condition score were grouped into poor, medium and good according to Nicholson and Butterworth (1986) after bovine in some modification.

Tick Collection and Preservation: Firstly, the selected study animals were properly restrained and the entire body of the animals selected as sampling unit was checked for any tick infestation. Ticks were removed from host skin for identification using hand manually according to Wall and Shearer (2001). The collected ticks were preserved in separate pre-filled

universal bottles containing 70% ethyl alcohol before transportation to Hawassa veterinary laboratory for tick identification. A format was used to register the data during tick collection and proper labeling was made on universal bottles with permanent marker. Date of collection, address, species, sex, age, body condition score, and management system of the animals and sites of attachment were included in the labeling.

Identification of Ticks: Stereomicroscope was used to identify the ticks based on their morphological features such as mouth parts, scutum, and color of legs, festoons, interstitial punctations, presence or absence of adanal shields, posterior groove and marginal spots. The taxonomic keys of Walker *et al*. (2003) were used to identify the ticks under stereomicroscope by manipulating each tick with wire loop.

Data Analysis: Analysis of obtained data was done by Chi-square (X^2) test to test the association between ticks infestation with different risk factors (breed, age, sex and body condition score, management system and animal origin). For this analysis, SPSS, version 20 was used. In all analysis, all statistics were considered as significant at $P<0.05$, while the confidence interval was set at 95% and 5% error probability.

Results

Overall Prevalence of Ticks and Identified Tick species: In this study, a total of 384 cattle were examined for the prevalence and identification of Ixodid ticks. Then the overall prevalence was calculated by dividing the number of positive samples by the total sample size and multiplied by 100. Out of the 384 animals examined, ticks were found on 296 animals yielding an overall prevalence of 77.1%. A total of 780 Ixodid ticks were collected from the 296 cattle which belong to two genera and two different species. *Ambloyomma varigatum* was the predominant tick species which was collected (504 in number with 43.2% prevalence), while *Rhipicephalus evertsi evertsi* was the next prevalent tick (276 in number with 33.9% prevalence) (Table 1).

Table 1. Prevalence of ticks and percentage of each tick species.

Tick species	Total animal		Total tick	
	Number of infected animals	Percentage (%)	Total number of collected ticks	Percentage of total ticks
A. variegatum	166	43.2	504	64.6
R. evertsi evertsi	130	33.9	276	35.4
Total	296	77.1		

Prevalence based on Breed, Sex, Age, Body Condition and Predilection sites of Animals: Regarding tick prevalence in relation with the different host related risk factors in the study, except in different age groups and in different breeds of animals, there were no statistically significant variations ($P<0.05$) in the tick prevalence. Higher tick infestation rate was seen in local breeds than exotic breeds and also higher tick infestation rates were seen in male animals and in animals with poor body condition (Table 2 up to 5). It was also revealed in this study that different tick genera have different predilection sites. According to the result of this study, both tick species (*A. variegatum* and *R. evertsi evertsi*) had strong preference for udder (Table 6).

Table 2. Prevalence of different tick species in different breeds of cattle.

Tick species	Breed			
	Local	Exotic	Total	P-value
A. variegatum	159 (41.4%)	7 (1.8%)	166 (43.2%)	0.001
R. evertsi evertsi	125 (32.6%)	5 (1.3%)	130 (33.9%)	
Total	284 (74%)	12 (3.1%)	296 (77.1%)	

Table 3. Prevalence of different tick species in male and female cattle.

	Cattle sex			
Tick species	Male	Female	Total	P-value
A. variegatum	94 (24.4%)	72 (18.8%)	166 (43.2%)	0.153
R. evertsi evertsi	69 (18%)	61 (15.9%)	130 (33.9%)	
Total	163 (42.4%)	133 (34.7%)	296 (77.1%)	

Table 4. Prevalence of different tick species in different age groups of cattle.

	Age groups				
Tick species	Young	Adult	Old	Total	P-value
A. variegatum	67 (17.4%)	49 (12.8%)	50 (13%)	166 (43.2%)	0.004
R. evertsi evertsi	58 (15.1%)	36 (9.4%)	36 (9.4%)	130 (33.9%)	
Total	125 (32.5%)	85 (22.2%)	86 (22.4%)	296 (77.1%)	

Table 5. Prevalence of different tick species in different body condition of cattle.

	Body condition				
Tick species	Poor	Medium	Good	Total	P-value
A. variegatum	65 (17%)	92 (24%)	9 (2.3%)	166 (43.2%)	0.182
R. evertsi evertsi	64 (16.7%)	62 (16.1%)	4 (1%)	130 (33.9%)	
Total	129 (33.7%)	154 (40.1%)	13 (3.3%)	296 (77.1%)	

Table 6. Distribution of tick species in different body or predilection sites of cattle.

	Tick species		
Predilection sites	*A. variegatum*	*R. evertsi evertsi*	Total
Udder	52 (13.5%)	59 (15.4%)	111 (28.9%)
Forelimbs	32 (8.3%)	-	32 (8.3%)
Scrotum	46 (12%)	-	46 (12%)
Anus	36 (9.4%)	10 (2.6%)	46 (12%)
Tail	-	27 (7%)	27 (7%)
Neck	-	13 (3.4%)	13 (3.4%)
Back	-	21 (5.5%)	21 (5.5%)
Total	166 (43.2%)	130 (33.9%)	296 (77.1%)

Prevalence based on Animal Origin and Cattle management system: The study animals were originated from four localities or origins of the study area and they were from extensive and semi-extensive management systems. The highest prevalence, 96 (25%) was recorded at Chafe area and in animals from extensive management systems with 163 (42.4%) (Table 7 and 8).

Table 7. Distribution of tick species in four origins/localities of the study area.

		Tick species			
Localities	Number of examined animals	*A. variegatum*	*R. evertsi evertsi*	Total	P-value
Chafe	113	51 (13.3%)	45 (11.7%)	96 (25%)	0.165
Datto	81	37 (9.6%)	24 (6.3%)	61 (15.9%)	
Tula	81	40 (10.4%)	31 (8.1%)	71 (18.5%)	
Mobile	109	38 (9.9%)	30 (7.8%)	68 (17.7%)	
Total	384	166 (43.2%)	130 (33.9%)	296 (77.1%)	

Table 8. Prevalence of different tick species in different cattle management systems.

	Management system			
Tick species	Extensive	Semi-extensive	Total	P-value
A. variegatum	97 (25.3%)	69 (18%)	166 (43.2%)	0.281
R. evertsi evertsi	66 (17.2%)	64 (16.7%)	130 (33.9%)	
Total	163 (42.4%)	133 (34.7%)	296 (77.1%)	

Discussion

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 (Goshu *et al*., 2007). The current study reveals that, total of 384 cattle from four local areas of the study areas were examined and overall of 296 (77.1%) cattle were found to be infested by different genera of ticks. This finding is greater than the report of Kebede *et al*. (2018) with overall prevalence of 69%, but it is less than the reports of Hagos and Berihun (2014), Nateneal *et al*. (2015) and Alemu *et al*.(2014) with overall prevalence of 86.1%, 82% and 81.5%, respectively. However, the overall prevalence of ticks in this study is almost similar with the report of Kibruyesfa and Achuna, (2017) with 77.6%. This difference could be due to the difference in the agro climatic condition of the study areas, since tick activity was influenced by rainfall, altitude and atmospheric relative humidity according to Pegram *et al*. (1981).

Amblyomma was found to be the more prevalent tick genera with a prevalence of 43.2% and 64.6% of total tick collected in the present study area. Likewise, Seid (2004) in Mizanteferi and Yitbarek (2004) in Jimma had reported high prevalence of *A. cohaerens* with a prevalence rate of 50.5% and 83.1% respectively. *Rhipicepalus evertsi evertsi* was the second abundant tick with a prevalence of 33.9% and 35.4% of total tick collected in the study area. This disagrees with the finding of Kibruyesfa and Achuna, (2017) who reported *Rhipicephalus evertsi evertsi* was the third most abundant tick species in their study with a prevalence rate of 11.7%. Similarly, *R. evertsi evertsi* was the second most abundant tick species with prevalence of 50.9% according to Abdisa (2012) and it was the most abundant tick species with prevalence of 53.4% according to Huruma *et al.* (2015). This might be due to the differences in the study areas, such as latitude, altitude and their effects (Sunlight, rainfall and wind patterns) that influence tick distribution and their activity according to Ammanuel and Abdu (2014).

In the present study, tick prevalence in different breeds of cattle was found to be statistically insignificant ($P<0.05$) (Table 2). The result of current study shows that the presence of tick infestation in local breeds was very high with prevalence of 74% and in exotic breeds with a prevalence of 3.1%. This agrees with the finding of Kibruyesfa and Achuna, (2017).

The significant variation in tick infestation of cattle of different breeds in the current research might be attributed 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 as well as taking more care to exotic breeds than local cattle.

The prevalence rate of tick infestation was found to be higher in male cattle (42.2%) than females (34.7%) in the present study (Table 3). This finding disagrees with the report of Nateneal *et al.* (2015) who indicated the prevalence of tick infestation in female and male cattle as 52.9% and 41%, respectively. Kibruyesfa and Achuna, (2017) also revealed the prevalence rate of tick infestation was found to be higher in female cattle (44.52%) than males (33.04%). The variation in tick infestation of male and female cattle in the current research might be attributed to differences in management systems.

In the present study, tick prevalence in different age groups was found to be statistically significant ($P<0.05$) (Table 4). It was observed that young cattle are very prone to tick infestation. This disagrees with the result obtained by Nateneal *et al*. (2015) in Bedele district, Western Ethiopia, where infection rate was much higher (66.3%) in 3 to 7 years of cattle. The higher proportion in young cattle may be due to outdoor management and movement of these animals to search for food and water.

In the current study, animals with medium body condition and good body condition were the most highly infested and the least infested ones by the ticks, respectively (Table 5). This finding is slightly in line with the work of Wolde and Mohamed (2014) and Nateneal *et al*. (2015) who reported cattle with poor body condition were significantly (P<0.05) infested more than that of cattle with normal body condition. This may be due to the fact that poorly conditioned animals were least resistant to tick infestation and lack enough body potential to build resistance whereas over conditioned animals showed reasonable combat to the infestation according to Manan *et al*. (2007). Alternatively, tick infestation might be a cause for poor and medium body condition; hence high prevalence was computed in these groups of animals.

A relatively high tick infestation (25%) was recorded at Chafe area. However, prevalence of tick infestation was statistically not significant (P>0.05) in all localities/origins (Table 7). The high prevalence at Chafe area might be due to having large common grazing area where animals stay the whole day time.

In relation to the attachment sites of ticks on the host body, different tick species were found to be having different predilection sites in this study. Accordingly, *Amblyomma variegatum* had strong preference for udder and scrotum whereas *Rhipicephalus evertsi evertsi* highly prefer udder and under the tail areas. The result of this study is in line with the results of Stachurski (2000) who stated that short hypostome ticks like *Rhipicephalus* usually prefer upper body parts including nape of neck and margin of anus and under tail, while long hypostome ticks like *Amblyomma* attaches to lower parts of the animal body which is also the case in the current study based on Tiki and Addis (2011).

Conclusion and Recommendations

The current study identified two species of ticks in the study area. *Amblyomma variegatum* was highly prevalent which is followed by *Rhipicephalus evertsi evertsi*. The result of the study indicated that ticks were widely spreaded and prevalent parasite affecting the cattle with an overall prevalence of 77.1%. This indicates that the prevalence of the tick is high in the study area. This poses huge economical and health constraint to the farmers and the animals in the area.

However, the attention given to the infestation was not sufficient. Acaricide application when the prevalence is aggravated is the only method of tick control in the district. Tick should be managed at an economically acceptable level by a combination of techniques. Therefore, systematic intervention and control of tick infestation should be put in place to tackle the problem.

Therefore, based on the above research results and conclusion, the following recommendations are forwarded:

- Awareness on tick control should be promoted among livestock owners.
- All stakeholders concerned with livestock production and healthcare programs should make concerted effort to plan and implement effective control programs on ticks and other external parasites.
- Sufficient budget should be allocated by the concerned body for the purchase of chemical sprays and spraying equipment on yearly basis.
- Further research should be conducted to identify tick up to its species level for combating species related problems.

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