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Study on Prevalence and Identification of Bovine Tick Species in Hetosa District of East Arsi Zone, Eastern Ethiopia

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Abstract

A cross sectional study was conducted to identify tick species infesting bovine and associated risk factors. Adult ticks were collected from 384 randomly selected cattle and identified to species level. Both physical examination and microscopical investigation were employed. A total of 279 adult tick species were collected from different body parts. The study revealed that there was high tick infestation in the study with an overall prevalence of 61.5%.Four tick species from four genera were identified. The tick species identified were *Ambylomma variegatum, Boophilus decoloratus, Rhipicephalus evertsi evertsi* and Hyalommamarginatumrufipes. Among the species identified in the study area *Ambylomma varigatum* was the most common and abundant (39.3%) tick. In the study area, the highest prevalence of *A.variegatum* and *H.marginatumrufipes* was recorded in cattle having poor body condition. Majority of *Ambylomma varigatum* were attached to genital parts and mammary gland(scrotum/udder), and *Boophilus decoloratustoneck*, udder and groin. There was statistically significant difference between all tick species and ticks predilection site ($p < 0.05$).High tick prevalence were attributed to the low attention given to tick infestation and lack of awareness on impact of tick and poor management system of farmer and low attempt made to control tick infestation in the study area. Therefore, effective tick control program should be formulated and implemented based on the distribution pattern of ticks and factors responsible for their distribution.

Keywords: Cattle, Hetosa, Ixodidae, Predilection site, Tick

Introduction

Ethiopia is known for its livestock population which accounts first in Africa and tenth in the world and have the highest draft animal population in the continent. The site and diversity of major agro-ecological zones of the country renders suitable environment for the support of large number and class of livestock (FAO, 1999).Even though the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. The most important constraints to cattle productions are widespread endemic diseases including parasitic infestation, poor veterinary service and lack of attention from government (Solomon, 2005). From health constraints livestock are highly affected by ectoparasites mainly ticks and tick borne disease which has directly affected the socio-economic development of poor farmers(William, 2001).

Ticks are obligate blood feeding ectoparasites of vertebrates particularly mammals, birds and reptiles throughout the world. They are cosmopolitan in distribution, but occur principally in tropical and subtropical regions with warm and humid climate which are suitable to undergo metamorphosis. Approximately 850 species have been described worldwide (William, 2001). Two well established families of ticks, the Ixodidae (hard tick) and the Argasidae (soft ticks) are important vectors for disease causing agents to humans and animals throughout the world. Over 79 different species of ticks are found in eastern Africa, but many of these appear to be of little or no economic importance (Kilpatrick *et al*., 2007).
In Ethiopia, about 47 species of ticks are found on livestock and most of them are important as vectors and also have damaging effect on skin and hide production (Anne and Conboy, 2006). Ticks transmit the wide varieties of pathogens including bacteria, rickettisia, protozoa and viruses. The major cattle tick borne diseases in Ethiopia are anaplasmosis, babesoisis, cowdrosis and theileriosis (ILRI-FAO, 2005).Ticks also cause nonspecific symptoms likeanemia, dermatitis, toxicosis and paralysis (Solomon *et al*., 2001).

Ticks are common in all agro ecological zones of Ethiopia (Pegram*et al*., 1981). Many reports by Mekuria (1987) in Nekemte, Asrat (1987) in Hararghe, Assefa (2004) in Asella, Birhane (2004) in Awassa, Belay (2004) in Mizan Teferi, and Getachew (2004) in Jimma indicated that Amblyomma tick species are widely distributed in Ethiopia with highest prevalence rate. Rhipicephalus is also predominant genera and has been reported with highest prevalence in GamoGofa(Abdo, 1986), Bale (Gardie,1988) and Southern Sidamo(Birru, 1988).

Although Amblyomma and Rhipicephalus ticks are predominating in many parts of the country, 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 (Solomon *et al*., 2001).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. Therefore, the objective of this study was to determine the prevalence of tick speciesin cattle in Hetosa district of Arsi zone, Eastern Ethiopia.

Materials and Methods

Study Area Description

The study was conducted from November 2017 to April 2018 in Hetosa district of Arsizone, Eastern Ethiopia. The area lies between 08° 08'N-08°13' E latitude and 39° 14' N -39° 23' E longitude with an elevation range from1500-4170meters above sea level. Hetosa is found at 160 km south east of Addis Ababa and characterized by mid subtropical temperature ranging from 5 C°-28 C°. The annual average rainfall is 1200 mm and mostly has clay type of soil and in some area black soil is abundant. The Hetosa district has an area of 937 km square and topographically has highland escapement and lowland areas. The high land areas are found centrally and the low lands dominate the periphery of the area. The livestock population of Hetosaworeda comprises about 148112 cattle, 63123 sheep, 44902 goats, 65972 equines and 76,677 poultry (APEDO, 2007).

Study population

The study populations were cattle lives in Hetosa district and kept under extensive production system with different age, sex, breeds and body conditions core.

Study design

A cross-sectional study design was conducted to identify the tick species, population dynamics of tick species and associated risk factors. Simple random sampling was used to select study animals. The age of animals was grouped as< 1 years, between 1-3 years and >3 years according to the classification method used by Delaunta and Habel(1986). Likewise, the body condition scores (good, medium and poor) were used based on the criteria set by Nicholson and Butterworth (1986).

Sample size determination

The sample size was determined by assuming the expected prevalence of 50% tick infestation. The desired sample for the study was calculated by setting 95% confidence level at 5% absolute precision (Thrusfield, 2007). Therefore, sample size of 384 cattle were examined in the study.

$$n = \frac{[1.96^2(p)\ (1-p)]}{d^2}$$

Where n= sample size; p= Expected prevalence; d= Desired level of precision (5%)

Sample collection

The entire body surface of the host was inspected for ticks. After fully restraining of the animal, all visible adult tick species were removed by hands holding the basiccapitulum so as not to lose the mouthparts of the ticks. Collection of ticks was done on udder/scrotum, neck, under tail, groin, leg and ear of the animal. Ticks from each animal and from each site were collected and preserved in separate universal bottles containing10% formalin that had been pre-labeled before transportation to parasitology laboratory for identification. Required information like date of collection, age of animal, sex of animal, body condition scores and site of collection were recorded. Tick species identification was done using a stereomicroscope at Asella Regional Veterinary Parasitology Laboratory.

Laboratory examination for tick identification

Identification procedure required both field work and laboratory identification of collected adult tick sample. The collected ticks were identified using stereomicroscope and classified to different genera levels based on size, mouthparts, colour of the body, leg colour, position and presence or absence of punctuations onthe body. Furthermore, different tick morphology such as shape of scutum, leg colour, body, festoon and ventral plates were considered for species level identification according to Walker*et al*. (2003).

Data Analysis

The collected data from field were entered into Microsoft excel spread sheet and analyzed Descriptive statistics, Chi-square test were done at 95% confidence level using Statistical Package for Social Students (SPSS) software version 20. Variables like age, sex andbody condition score were considered as factors that could determine the distribution of the ticks. P value is less than 0.05 was considered as statistical significant.

Results

A total of 279 ticks were collected from six body region of 384 cattle sampled and236(61.5%) cattle were found to be positive for tick infestation. Four Ixodidae tick genera and four species namely *A. variegatum, B. decoloratus, Rhip.evertsievertsi and H. marginatumrufipes* were identified from the study area. From a total of 384 bovineanimalsexamined for tick, 198 were males and 186 females, according to their age 2 animals were <1 years,59 animals were between 1-3 years and 323 animals were >3 year age. Again 36 cross and 348 local breed as well as 201 poor,78 medium and 105good body condition score cattle were considered for this study.

Regarding the host related factors in the study, there was no statistically significant variation ($P > 0.05$) in prevalence of ticks between the sex, age, breed, and body condition score of animals. The prevalence of tick identified in local breeds was 60.9% (n=212) and 66.7% (n=24) in cross breeds. The body condition score of the cattle population was found to be variable among tick identified. Accordingly, high prevalence were recorded in animals having poor body condition 66.2%(n=133) than that of cattle having good body condition 55.2%(n=58)(table 1).

Table 1: The association of the host risk factors(variables) with the presence of the ticks

Host Risk factors	Categories	Number of animals examined	Number of animals infested by ticks	Percentage	X^2	P-value
Sex	Male	198	130	65.7	3.04	0.08
	Female	186	106	57		
Age	< 1year	2	2	100	4.17	0.12
	1-3year	59	42	71.2		
	>3 year	323	193	59.4		
Breed	Cross	36	24	66.7	0.46	0.500
	Local	348	212	60.9		
BCS	Poor	201	133	66.2	4.07	0.131
	Medium	78	45	57.7		
	Good	105	58	55.2		

n=number of animals infested by ticks

A. variegatum was the most abundant tick species and it represents 151(39.3%)of the total ticks collectedfollowedby*B.decoloratus*75(19.5%)and*Rhip.evertsievertsi*43(11.2%).*H. marginatumrufipes*10(2.6%) were found to be the least abundant tick species in this study area (table 2).

Table2: Identification of the different species of ticks

Tick species	Total Number of Ticks	Percentage
A. variegatum	151	39.3
B. decolaratus	75	19.5
R. evertsievertsi	43	11.2
H. marginatumrufipes	10	2.6

In the present study, the prevalence of all tick species was higher in male animals than female animals, except *H.marginatumrufipes* which had little difference in both sexes(p>0.05).Again in this study, there was no statistically significant variation (P > 0.05) in prevalence of *R.evertsievertsi* and *H.marginatumrufipes* between the, sex, age, breed and body condition score and the prevalence of *A.variegatum* and *B.decolaratus* between the sexes of animals. But there was significant prevalence of *A.variegatum* between body conditions core (p>0.05), and there was higher prevalence of *A.variegatum* in cattle with poor body condition(46.3%).The prevalence of *B.decolaratus* among age and breed was also statistically significant(p < 0.05)(table 3).

Table 3: The association of prevalence of different species of ticks in different category of variables

Variables with their X^2 and P-value		Types of tick species			
		A.variegatum No(%)	*B.decolaratus* No (%)	*R.evertsievertsi* No (%)	*H.marginatumrufipes* No (%)
Sex	Female	67(36)	32(17.2)	18(9.7)	5(2.7)
	Male	84 (42.4)	43(21.7)	25(12.6)	5(2.5)
	X^2	1.65	2.24	0.83	0.01
	P-value	0.19	0.30	0.36	1.00
Age	<1 year	2(100)	2(100)	0(-)	1(50)
	1-3 year	24(40.7)	20(33.9)	6(10.2)	1(1.7)
	>3 years	125(38.7)	53(16.4)	37(11.5)	8(2.5)
	X^2	3.19	18.11	0.33	17.92
	P-value	0.23	**0.006**	0.87	0.052
Breed	Cross	11(30.6)	15(41.7)	0(-)	0(-)
	Local	140(40.2)	60(17.2)	43(12.4)	10(2.9)
	X^2	1.28	22.64	5.00	1.06
	P-value	0.26	0.00	0.02	0.60
BCS	Poor	93(46.3)	40(19.9)	20(10)	8(4)
	Medium	28(35.9)	13(16.7)	9(11.5)	0(0)
	Good	30(28.6)	22(21)	14(13.3)	2(1.9)
	X^2	9.53	1.48	0.80	3.79
	P-value	0.009	0.87	0.67	0.16

Ticks were collected and identified from different body parts of the animals. Among these predilection sites; under tail, udder /scrotum, neck, groin, Leg and Ear were the major sites. The difference among different predilection site (location of ticks on animals) in association with sex, and body condition scores were found statistically insignificant (P>0.05).But the association of location of ticks on animals with age and breed was statistically significant (table 4).

Table 4: The difference in the tick's predilection site within the different variables

Factors with their respective X^2 and P-value		Predilection site					
		Under Tail No(%)	**Udder/scrotum No (%)**	**Neck No (%)**	**Groin No (%)**	**Leg No (%)**	**Ear No (%)**
sex	Male	13 (6.6)	55 (27.8)	19(9.6)	15(7.6)	5(2.5)	1(0.5)
	Female	12 (6.5)	48 (25.8)	19(10.2)	7(3.8)	4(2.2)	2(1.1)
	X^2	6.65	6.65	6.65	6.65	6.65	6.65
	P-value	0.69	0.69	0.69	0.69	0.69	0.69
Age	<1 year	0(-)	2(3.4)	0(-)	0(-)	0(-)	0(-)
	1-3 year	1(1.2)	18(30.5)	11(18.6)	2(3.4)	3(5.1)	0(-)
	>3 years	24(7.4)	85(26.3)	27(8.4)	20(6.2)	6(1.9)	3(0.9)
	X^2	53.75	53.75	53.75	53.75	53.75	53.75
	P-value	0.022	0.022	0.022	0.022	0.022	0.022
Breed	Cross	0(-)	8(22.2)	3(8.3)	7(19.4)	1(2.8)	1(2.8)
	Local	25(7.2)	95(27.3)	35(10.1)	15(4.3)	8(2.3)	2(0.6)
	X^2	20.74	20.74	20.74	20.74	20.74	20.74
	P-value	0.024	0.024	0.024	0.024	0.024	0.024
BCS	Poor	10(5)	64(31.8)	20(10)	9(4.5)	5(2.5)	2(1)
	Medium	7(9)	22(28.2)	3(3.8)	7(9)	2(2.6)	0(-)
	Good	8(7.6)	17(16.2)	15(14.3)	6(5.7)	2(1.9)	1(1)
	X^2	22.79	22.79	22.79	22.79	22.79	22.79
	P-value	0.199	0.199	0.199	0.199	0.199	0.199

The predilection sites of ticks was also seen at species level of the ticks. .*A. variegatum* was mostly tend to attach to genital parts and mammary gland (scrotum/udder)(60.9%)),neck(11.3%)andgroin(6%).*B oophilusdecoloratus*was collected from neck(28%),udder (14.7%) and groin(17.3%) and *Rhipicephalus evertsi evertsi* from anal region (anus/under tail) (58.1%).Again *H.marginatumrufipes* was attached to udder and neck(60%). Statistical significant difference was found between all tick species and predilection site of ticks to host ($p < 0.05$) (table 5).

Table 5: Distributions of tick species and proportion on different attachment site of animals Body.

Attachment Site of animals	*A.varigatum*	*B.decolaratus*	*R.evertsievertsi*	*H.marginatumrufipes*	Total
	No (%)	**No (%)**	**No (%)**	**No (%)**	**No (%)**
Under tail	1	0	25 (58.1)	0	26 (59.1)
Udder/Scrotum	92 (60.9)	11 (14.7)	0	1	104 (75.6)
Neck	17 (11.3)	21 (28)	1 (2.3)	0	39 (59.3)
Groin	9 (6)	13 (17.3)	0	2 (20)	24 (43.3)
Leg	1 (0.7)	9 (12)	0	0	10 (12.7)
Ear	1 (0.7)	3 (4)	0	0	4 (4.7)
Under tail, udder and neck	6 (4)	7 (9.3)	6 (14)	1 (10)	20 (37.3)
Udder and neck	16 (10.6)	10 (13.3)	2 (4.7)	6 (60)	34 (88.6)
Under tail and udder	9 (6)	0	9 (2.9)	0	18 (8.9)
X^2	2.6	2.09	3.47	77.6	
P-value	**0.00**	**0.00**	**0.00**	**0.00**	

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 (Solomon *et al*., 2001; Goshu *et al*., 2007). In the present study, the overall prevalence of tick identification at Hetosa district of Arsi Zone was 61.5%. This finding was in agreement with Wasihun and Doda (2013) who reported 61% at SNNP region of Ethiopia and Tadesse and Sultan (2014)who reported59.4%at Fitche,Selale, North Shewa, Ethiopia. However, it is higher than the finding of Tiki and Addis (2011) at Holetta, central Ethiopia and that of Haile and Zeryehun (2013) from Bench Maji zone, southwest Ethiopia with overall prevalence of 25.6% and 27.3%, respectively.

In addition, various researcher works has proven to find high prevalence of tick infestation than the present study including the reports of Gedilu *et al*. (2014) in Bahir Dar, andAlemu *et al*. (2014)in Northwest Ethiopia, with overall prevalence of74%and81.5%, respectively. This difference could be due to the variation in the agro climatic condition of the study areas, since tick activity was influenced byrainfall, altitude and atmospheric relative humidity (Pegram *et al*., 1981).

The most abundant tick species in the study area was found to be *A. variegatum* (39.3%). The reason could be attributed to the fact that this species is the most widely distributed tick in Ethiopia due to suitable wooded or grassy environments (Morel, 1980;Pegram*et al* 1981).This result is higher than that of Bossena and Abdu (2012) who reported 23.4% in and around Asosa and that of Tadesse *et al* (2012) in MezanTeferi (18.1%). However, Tamiru and Abebaw (2010) reported higher prevalence (48.2%) in and around Asella, South East of Ethiopia. Those variations could be due to agro-ecological differences in the study sites which may probably favors the survival of ticks, livestock management systems including the use of insecticides and other preventives measures.

B. decoloratus is one of the most important cattle ticks in Ethiopia for its parasitic effect (Morel, 1980). Accordingly, it was the second most abundant (19.5%) tick species that was identified in the study area. This finding slightly agrees with that of Belew and Mekonnen (2011) in and around Holetta and Tamiru and Abebaw (2010) in and around Asella who reported 18.1% and 15.4% tick infestation prevalence, respectively. On the other hand, this finding was lower than that of Bossena and Abdu (2012)in and around Asossa town, western Ethiopia, Alemu *et al*. (2014) in Northwest Ethiopia, Gedilu *et al*. (2014) in Bahir Dar and Bedaso *et al*. (2014)in and around Haramaya town, Ethiopia, who reported *Boophilus decoloratus* as the most abundant tick species with respective prevalence of 70.3%,40.86%, 47.93% and 26.3%, respectively. On the other hand, Regassa (2001) reported a lower prevalence (1.60%) at Borenaranch. This might be due to the management differences as the ranch have had its own tick control measures on relative bases that reduces tick burden on study animals. *B. decoloratus* is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfallannually (Pegram *et al*., 1981).

R. evertsievertsi was the third most abundant tick species in the present study area with prevalence of 11.2%, which is in agreement with reports of Alemu *et al*. (2014)in Northwest Ethiopia, with prevalence of 11.51%. The result was lower than that of Hussen (2009) (21.5%) in Bako, western Ethiopia, Belew and Mekonnen, (2011)(29.3%) in and around Holetta and Bossena and Abdu, (2012) (30.5%) in and around Asossa. The native distribution of R.*evertsievertsi* in Ethiopia seems to be connected with middle high dry savanas and steppes, in association with zebra and ruminant and it is widely distributed throughout Ethiopia (Belew and Mekonnen, 2010).Pegram *et al*. (1981)reported that this species had not showed specific preferences for a particular altitude, rainfall zones or seasons.

H.marginatumrufipes was the least abundant tick species collected and represented only 2.6%.Tamiru and Abebaw,(2010) has similar resultin Assella, who reported a prevalence of2.5%. But this result was slightly higher than that of Regassa, (2001)(0.08%) in Borenaprovince, Hussin(2009) (1.2%) in Bako, and Tiki and Addis(2011) (1.86%) in and around Holeta. The low prevalence of this tick species in this study area could be due to the fact that *H.marginatumrufipes* is mostly found in arid part of tropical Africa that receive about 250 to 650 mm annual rainfall and rare in western and Central Highland of the Country. In Ethiopia altitude is often between 1000-2500 m above sea level and this makes the prevalence of this parasite to be very rare (Pegram *et al.*,1981).

Each tick species have their own predilection site of attachment on their host. The hard tick infestation on neck and mammary glands was most prevalent in cattle (88.6%) which was higher than report of Wolde and Mohamed (2014) at southern part of Ethiopia and Kabir*et al*. (2011)(48.75%) at Bangladesh; whereas lowest in face and ear region(4.7%) which was lower than Kabir *et al*. (2011) (30.0%) report. In fact, Stachurski(2000) states that short hypostometicks like Rhipicephal ususually prefer upper body parts including margin of anus and undertail while long hypostometicks like Amblyomma attaches to lower parts of the animal body, which is also the case in the present study.

In this study, the frequency of infested body of animals was udder, scrotum, ear,groin,neck,tail and leg. Among ticks attachment site, udder and neck (88.6%),was the preferred sites followed by scrotum (75.6%) and groin (43.3%). This result was higher than the result reported by Ammanuel and Abdu(2014) who reported (31.1%) on udder/scrotum, groin(26.6%). The predilection site mentioned in the result of this study was also reported by other researchers such as Pawlos and Derese (2013) in humbo district, Hussen (2009) in Bako town reported that ano-vulva was the first site of the attachment site of ticks which is in contradiction with this findings, and Gazali(2010),around Mezan Teferi, Ethiopia reported that udder/scrotum (33.95%) was preferred site for tick attachment incattle.The prevalence of tick species identified was higher inanimals<1 year than in animals>3 years instudy area. But the difference was insignificant. This finding disagrees with the finding of Feseha (1997), Tessem aand Gashaw (2010) and Tiki and Addis (2011), who reported a higher proportion of infestation in adult cattle than the younger ones.

The prevalence of all tick species was higher in male animal than female animals, except *H.marginatumrufipes* which had almost equal prevalence in both sex.Similarly, other authors (Hussen, 2009; Pawlos and Derese, 2013) reported a higher tick infestation in male animals than females. This minor variation might be due to the fact that female animals may receive good management indoor for dairy purpose whereas male animals grazing on field might be exposed to tick infestation.

In the study area, the highest prevalence of*A.variegatum* and *H.marginatumrufipes*w as recorded in cattle having poor body condition and lowest in cattle having good body condition. This finding was in line with the work of Bilkis *et al*.(2011) and Wolde and Mohamed (2014) who reported cattle with poor body condition were infested more than that of cattle with normal body condition. This may be due to the fact that poorly conditioned animals had 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 body condition; hence high prevalence was computed in this group ofcattle. The local breeds are highly infested by the tick species like *A.Variegatum, R.evertsievertsi* and *Hyalommamar ginatumrufipes.*Opposite to this there was high prevalence of *B.decolaratus*in cross breed.

The significant variation in tick infestation of cattle of different breeds in the present study might be attributed to differences in management systems, lack of supplementary feeding that result in low immunity 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 cross breed than local cattle. Moreover, local breeds are kept under extensive production system as compared to cross breeds which are kept under semi-intensive farming system. This situation could be hypothesized that regular washing of barn and animal, regular treatment of animals with acaricides will reduce the susceptibility of tick infestation in semi intensive animal whereas, extensive cattle are move anywhere for grazing, so susceptibility of tick infestation is higher.

Conclusion

Field assessments and laboratory identification of the ticks was done to identify tick infestation in the cattle. The study result indicates that ticks are widely distributed throughout the study area and animals were infested with different species of tick. The important and abundant tick species investigated in the study area were *A. variegatum. B.decolaratus, R. evertsievertsi*, and *H.marginatumrufipes*. The most infested part of the animal were udder and scrotum followed by neck and groin. The present finding attributed to the low attention given to tick infestation in the area and lack of awareness on impact of tick and poor management system of farmer and low attempt made to control tick infestation in the study area. Therefore, tick control programs and appropriate pasture management in communal grazing area should be practiced to reduce tick infestation.

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