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Prevalence of Ixodidae Ticks of Cattle in Sodo zuria districts of Wolayita zone, Ethiopia

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Abstract

A cross sectional study was conducted from November, 2017 to April, 2018 in SoddoZuriaworeda, Wolayita zone with the aim of determining the prevalence of tick infestation of cattle and identifying the common tick species in the study area. Adult ticks were collected from seven main body regions of 501 cattle which were under extensive management system. Out of the total 501 cattle examined, 327 (65.26%) were found to be infested by one or more tick species. In the current study, 3290 adult ticks were collected from the animal body parts and identified to genera and species level. Four tick species of three genera (*Amblyomma*, *Boophilus* and *Rhipicephalus*) were identified. The relative prevalence of each species was *Boophilus decolaratus* (45%), *Amblyomma varigatum* (23%), *and A. cohaerence* (17%), and *Rhipicephalus evertsi-evertsi* (13%). Out of the risk factors sex of cattle was not did not show significant association with the infestation rate but, there was significant association with age, breeds and body conditions. The prevalence of tick infestation in poor body condition (75%), medium body condition (61%) and good body condition (55%) was found to be statistically significant ($P < 0.05$) among the three groups of body conditions. The prevalence of tick infestation was found to be statistically significant ($p < 0.05$) among the three breeds, with highest prevalence in local breeds (70%) of both exotic (62%) and cross breeds (54%). The result indicated that the favorable predilection sites of *Amblyomma* species were ventral body and perineum. The sex ratio of all tick species identified during this study periods was skewed towards male except for *B. decolaratus*. Considering the economic importance of tick and tick-borne diseases in Soddo Zuria district, also in the country Ethiopia, there should be country wide control strategy, taking into account acaricide residues in products.

Keywords: Cattle; Ixodidae; Soddo; Species; Tick

Introduction

Ethiopia, located in the horn of Africa, between latitude of 30 to 15°N of the equator and longitude 33 to 48°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 zonation which makes the country suitable for different agricultural production system. This in turn has contributed to the existence of large diversity of farm animals' genetic resources [1]. The proportion of farm animals from total population in agricultural sector is 82.4%. The country has the largest number of livestock in Africa, approximately 50,884,005 heads of cattle, 25, 979, 919 sheep, 21, 960, 706 goats, 1,995,306 horses, 5,715,129 donkeys, 365,584 mules and 807,581 camels [2]. In spite of large livestock population, the productivity remains marginal due mainly to malnutrition, prevalent diseases and

management problems. The rate of food production is much less when compared to the rate of growth of human population. Therefore, the country is unable to assure adequate food for the people. However, among livestock, cattle play a significant role in socio-economic life of the people of Ethiopia. In contrary to this, ecto-parasites, such as ticks, mites and lice have veterinary importance which affects economics of cattle production in the country [3, 4]. 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 cattles are infested with ticks. Beside to the phylum Arthropod, class Arachnid, and order Acari, ticks family are categorized into two, the Ixodidae (hard ticks) and Argasidae (soft ticks). Most of the Ixodids and Argasids pass through four stages in their development; eggs, 6-legged larva, 8-legged nymph and adult [5]. According to the numbers of hosts, Ixodids ticks are classified as one-host ticks, two-host ticks, three-host ticks and Argasids classified as multi-host ticks. In one-host ticks, all the parasitic stages (larva, nymph and adult) are on the same hosts. In two- host ticks, larva attach to one host, feed and moult to nymphal stage and engorged, after which they detach and moult on the ground to adult. In three-host ticks, the larva, nymph and adult attach to different hosts and all detach from the host after engorging, and moult on the ground. In multi-host ticks (Argasids), a large number of hosts are involved and it is common to have five moults, each completed after engorging and detaching from the hosts [6].

Ticks are most numerous, particularly in tropical and sub-tropical regions, and their impact on animal health and production is greatest in these regions [7]. Compared to mites, Ticks are usually relatively large and long lived, surviving for up to several years [8]. Though sharing certain basic properties, ticks differed in many structures, behavioral, physiological, and feeding and reproduction pattern [9]. Ticks that are considered to be most important to domestic animals' health in Africa comprise about seven genera and forty species. Among these tick genera, the main ticks found in Ethiopia are *Ambylomma, Boophilus, Heamaphysalis, Hyalomma, and Rhipicephalus*[5, 10]. Among these, *A. varigatum and B. decoloratus*are most important and widely distributed [11].

Even though there were number of studies on ticks and tick-borne disease in many parts of Ethiopia, they were not sufficient to overwhelm the problem in the area. The current study area is one of the areas with insufficient relevant information in tick infestation of cattle. Therefore, the objectives of this study are to estimate the prevalence of tick infestation of cattle and to identify the common tick species in around Soddo district.

Materials and Methods

Description of Study Area

The study on tick infestation was conducted in South Nation Nationalities and Peoples Region, Wolaita zone particularly, in Soddo Zuria woreda from November, 2017 to March, 2018. The Soddo town is located 380 kms South West of Addis Ababa on the way to Arbaminch town and it has a latitude and longitude of 6°54′N 37°45′E with an elevation between 1650 and 2980 meters above sea level. The town is bounded with Damot Gale Woreda to the North, HumboWoreda to the South, Damot Woide Woreda to East and Damot Sore Woreda to the West. The annual rain fall of the area is 1000-1200 milimeters. The dry season extends from September to February and the rain season stay from March to August. The livestock population of the area comprised about 1,097,710 cattle; 150,383 sheep; 185,250 goats; 60,055 equines and 734,924 poultry [12].

Study Population

The cattle population found in Soddo Zuria woreda was considered as a study population. The study populations were constituted in all breeds that are known as local, cross and exotic breeds depending on their respective Blood level. The local breeds have pure indigenous traits, cross breeds have both indigenous and exotic traits about less than 75% and exotic breeds are considered having more than 75% of exotic trait.

Sampling design and sampling technique

A cross sectional study was conducted at the current study area to determine the prevalence of ticks, and identification of species of ticks collected and labeled according to predilection site. All the animals selected as sampling unit were checked for any tick infestation based upon the numbers of ticks found on the animal and the study record period. Ticks were collected from ears, heads, dewlaps, belly/ flunk, udder/ scrotum, perineum and legs/ tails in the separated sample bottles with 70% ethanol. In addition to the attachment

site of tick in different body regions, the burden of ticks based on age, sex, body condition, and breeds of animals were determined.

Sampling Methods and Determination of Sampling Size

The cattle to be examined were selected by simple random sampling method, and multistage sampling strategy was used to determine appropriate sample size. The sample size was determined according to the formula given by Thrusfield [13] by using 65.5% of expected prevalence of Ixodidae ticks in cattle from the previews report of the work done in the study area by Ammanuel and Abdu [14]. The other parameters used were 95% confidence interval and 5% desired level of precision. By substituting these values in the formula, the sample size taken was calculated as follows;

$$N = \frac{1.96^2 Pexp\ (1\text{-}Pexp)}{d^2}$$

Where;
n = sample size; Pexp = expected prevalence; d = desired absolute precision

Accordingly, total sample size of 347 cattle was required. However, a total of 501 study animals were sampled to increase the precision of the estimated prevalence at the study area.

Study Methodology

Firstly, the selected study animal was properly restrained and all tick samples were collected from ears, dewlap, head, belly/flunk, udder/scrotum, perineum and legs/tail regions. Ticks were removed carefully and gently by using forceps in a horizontal pull to the body surface. The age of the cattle was grouped into young (1 to 2 years), adult (3 to 7 years), and old (>8 years) according to Gatenby [15] and Abera et al. [16], while body condition score was employed after categorizing the animals into poor, medium, and good according to Nicholson and Butterworth [17] after some modification. Extremely lean cattle, having prominent dorsal spines pointed to the touch and individual visible transverse processes into which a finger could be easily pushed, were considered as poor body condition score. A medium body condition score cattle was expressed as having usually visible ribs with little fat cover and barely visible dorsal spines. A good body condition score was given for the animals when fat cover easily seen in critical areas and felt and the transverse processes were not seen or felt.The ticks collected during the study period were preserved in universal bottles containing 70% ethanol and labeled with respect to predilection site, age, sex and date of collection, then transported to WolayitaSoddo Regional Veterinary Laboratory for counting and identification. 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*. [18]. Each identified ticks were collected in separate bottles.

Data analysis

The data collected were entered and managed in Microsoft-excel and Statistical program (SPSS 20 version) [19] was employed for the data analysis. The overall prevalence of tick was determined by dividing the number of positive animals by total sample size, and was expressed as percentage. Chi-square (X^2) and P- value test were used to assess if there was a statistically significant association in tick infestation between ages, sex, breeds and body conditions.

Results

Overall prevalence at the area was 65.26% (327/501). Out of all examined (501) animals, local breed (n = 308), cross breed (n = 137), and exotic breed (n = 56). The distribution of tick genera identified were *Amblyomma*, *Boophilus*, and *Rhipicephalus* with the ratio of 40.55%, 45.47%, and 13.98% as indicated in the table below (Table 1). The infestation rate among different breeds was 70.77%, 62.5%, and 54.01% in local, exotic and cross breeds, respectively. There was statistically significant association with breeds (*P = 0.003*). Body condition was one of the risk factors assessed at the area and the animals with poor body conditions were affected with highest rate following medium and good body conditions with a percentage of 75.7%, 61.65%, and 55.93%, respectively. There were also statistically significant association between body condition and the prevalence of the tick infestation *(P = 0.001*) (Table 2).

Predilection site of identified ticks

The observed proportion of tick species attachment site during this study was summarized and shown in Table 4 below. Both two species of *Ambylomma* identified during the study preferred udder/scrotum,

dewlap/brisket, perineum, belly/back, legs/tail and head regions. The *B. decolaratus* preferred the attachment site such as dewlap/brisket, belly/back, legs/tail, udder/scrotum, heads, ears, and perineum regions. The *Rhipicephalus* species were encountered mainly in the perineum, dewlap, udder/scrotum, ears, and belly/back and head region.

Table 1: Distribution of tick genera of cattle in the study area

Study area /Kebeles/	Tick genera							
	Amblyomma		Boophilus		Rhipicephalus		Total	
	NO.	%	No.	%	NO.	%	No.	%
Bugemanicha	194	39.04	213	42.85	90	18.11	497	15.11
DalboAtiwaro	172	33.26	270	52.22	75	14.5	517	15.72
Gulgula	262	40.74	300	46.65	81	12.59	545	19.54
Offa Gandaba	245	44.95	221	40.55	79	14.49	545	16.56
WachigaBusha	249	42.13	273	46.19	69	11.67	591	17.96
WarazaLashu	212	42.65	219	44.06	66	13.27	497	15.11
Total	1334	40.55	1496	45.47	460	13.98	3290	100.00

Table 2.Prevalence of tick in relation to bodyconditions and breeds of animals

Parameter	Body condition			Breed		
	Good	Medium	Poor	Local	Cross	Exotic
No. of animals examined	118	206	177	308	137	56
No. of animals infested	66	127	134	218	74	35
Prevalence (%)	55.93	61.65	75.7	70.77	54.01	62.5
X^2	14.2337			11.9698		
P value	0.001			0.003		

Table 3 Prevalence of tick in relation to sex and age of animals

Parameter	Sex		Age	
	Male	Female	≤4 years	>4 years
No. of animal examined	222	279	206	295
No. of infested animals	144	183	118	209
Prevalence (%)	64.86	65.59	57.28	70.85
X^2	1.233		9.8475	
P value	0.534		0.01	

Table 4. Numbers of tick Species identified in different body region/site of cattle.

Tick species	Body regions						
	Head	Ear	Dewlap	Legs/tail	Udder/scrotum	Perineum	Belly
A.varigatum	30	-	283	32	273	123	18
A.coherence	5	-	59	20	249	161	82
B.decolaratus	62	64	545	159	359	79	228
R.eversi-eversi	13	41	124	5	89	165	23
Total	110	105	1011	216	969	528	351

Identification of tick species and their abundance

Of the total 3290 Ixodid ticks collected from seven body region of 327 cattle, four different species in three genera were identified. The tick species identified were *B. decolaratus* (45.47%), *R. evertsi subspecies evertsi*(13.98%), *A. varigatum* (23.04%) and *A. cohaerence* (17.5%). By considering relative abundance of each tick species identified in the study area, *B. decolaratus* was the most abundant (45.47%) and *R. eversi subspecies eversi* was the least abundant (13.98%) (Table 5).

Prevalence of tick species in relation to sex of ticks

The number of ticks collected from the cattle was dominated by male ticks with an exception to one host tick (*B. decolaratus)* of which number of females was higher than that of males (Table 5).

Table 5.The distribution and sex ratio of adult tick species in the study area

Tick species	Total count	Prevalence (%)	Sex		Ratio
			Male	Female	(Male: Female)
B. decolaratus	1496	45.47	13	1483	0.008:1
A. varigatum	758	23.04	648	110	5.891:1
A. coherence	576	17.5	520	56	9.285:1
R. eversi-eversi	460	13.99	405	55	47.363:1
Total	3290	100.00	1586	1704	0.931:1

Discussion

The prevalence and distribution of the most common tick species infesting cattle was different from area to another area. In the present study, detailed investigation was carried out to identify and determine the type of species and predilection site of ticks infesting cattle in Soddo Zuria district. Four species of ticks namely, *B.decolaratus, A.varigatum, A.coherence* and *Rhipicephalus evertsi evertsi* were identified. As the current study revealed, *B. decolaratus* were found to be the most abundant tick species in Soddo Zuria district (45.47%). This finding agree with Sileshi *et al*.[20] who described that *B. decolaratus*was the commonest and most wide spread tick in Ethiopia, collected in all administrative regions except in the Afar region.

The current finding was also in line with Tamru [21] in Asela, and Teshome *et al.* [22] reported the highest prevalence of *B. decolaratus*(80%) in the study areas.

A. varigatum was the second widespread tick species of the cattle in the current study area (23.04%). This result disagreed with different reports done by other authors in different parts of Ethiopia such as Tessema and Gashaw [23] in Asela, Belew and Mekonnen [24] in Holeta, Seyoum [25], Mehair [26] in Awassa who were reported *A. varigatum* as the first most abundant tick species in their study areas. The difference in result was due to the geographical location where *A. varigatum* was found in highest number in the highland and high rainfall, and also due to its being relatively active throughout the year in most part of Ethiopia. *A. varigatum*is a widely distributed cattle tick in Ethiopia as mentioned by Morel [27], and it is a potential vector of diseases caused by *Cowdria ruminantium, Theleriamutan, T. velifera* ("benign bovine thelieriosis") and viral diseases, Nairob sheep disease, and also aggravates the situation of bovine dermatophilosis *(Dermtophilus congolence*) [20]. The study conducted in Wolaita zone by Dessie and Getachew [28] agreed with the current finding as they reported, A. *varigatum* was the second abundant tick species at highland and midland, and the first abundant in the lowland during wet period. This variation may be due to the change in environmental conditions, with the result of global warming that highly affect the ecology of ticks. Change in temperature and rainfall have been reported to affect the distribution of diseases of vectors and tick-borne diseases [6].

A. cohaerence was the third abundant tick species (17.5%) in the study area. *Amblyomma coherence i*s the most prevalent and abundant tick on cattle [29]. According to Tesfahey wet and Simeon [30], *A. cohaerence* was also the third abundant tick species in the Bench Maji zone with the prevalence of 4.2% in the area. The prevalence of *A. cohaerence* is alarmingly important as this tick has been reported as a vector for *C. ruminantium* which is the causative agent of cowdriosis ("heart water") [20]. Moreover, *Amblyomma coherence* transmits Ehrlichiosis, but less important vector than *A.varigatum* [31]. Another report indicated spontaneous infection of *Amblyomma coherence* by *Rickettsia conorii* in Ethiopia [32].

R. evertsi-evertsi was found to be the least abundant (13.98%) tick species in the current study area. The native distribution of *R. evertsi-evertsi* in Ethiopia seems to be connected with middle height dry Savannas and steppes, in association with zebra and ruminant and it is widely distributed throughout Ethiopia [24]. This tick species shows no apparent preference for particular altitude, rainfall zone or seasons [29]. According to Sileshi *et al.* [20], *R. evertsi-evertsi* was collected throughout their study period, with the peak of abundance in January coinciding with the beginning of the rainy season and they also described that the discovery of this tick in that area was in line with its widespread occurrence in most parts of the country. The occurrence of this species in and around Wolaita zone was also reported by Dessie and Getachew [28]. *R. evertsi-evertsi* has short mouth parts with which to feed on soft area. As a result, it is a possible vector of *Babesia, Rickettsia* and *Theleria*[8].

Ticks are known to be distributed in different parts of the host's body. In this study, the main infestation site of ticks in the body of hosts was dewlap, udder/scrotum, perineum, and belly. A variety of factors such as host density, interaction between tick species, time and season, and inaccessibility for grooming determined the attachment site of the ticks on the skins [31]. The predilection sites found in this study were in line with those reported by Seyoum [33] and Behailu [34] in their study conducted in North Wollo zone and Asela, respectively.

In the current finding, different animal related risk factors were studied to determine whether there is a significant variation in tick infestation between and among different groups of animals with suspected risk factors. The proportion of tick infestation was higher in adult animals as compared to young animals. As a result, there was statistically significant association ($p < 0.05$), and the higher proportion may be due to outdoor management and long distant movement of adult animals to search for food and water compared to younger animals, so the chance of exposure is higher. This finding is also in agreement with the finding of Feseha [35], Tessema and Gashaw [23] and Belew and Mekonnen [24] who stated a higher proportion in adult cattle. There was statistically non-significant association ($p > 0.05$) in the infestation rate among different sex groups, where higher infestation was recorded in female animals compared to their counter parts. Higher infestation in female was may be due to seasonal variation in some hormones like prolactin and progesterone at higher level and stressors of production (such as pregnancy and lactation) make female animals more susceptible than male. This result disagreed with the previous work done by Hussen [36] in Bako.

The proportion of tick infestation was higher in poor body conditioned (75.7%) as compared to medium body conditioned (61.65%) and good body conditioned animals (55.93%). This was probably due to the fact that poor body conditioned animals had reduced immunity and were exposed to any kind of disease when grazing on the field. The observation indicates that poor body conditioned animals were less resistant to tick infestation and lack enough body potential to build resistance with age advancement. Several researchers were reported that high infestation of tick results in poor body condition due to consumption of high amount of blood and fluids by those ticks [37]. Furthermore, Aerts and Neshem [38] who reported that the British cattle breeds having the lowest body condition score under tropical conditions had the highest infestation of ticks, Seid [39], Southerest [35] and Bianchi *et al.* [40] reported that tick load on animal is affected by breed and nutritional stress. Ultimately, these factors affect general body condition, which in turn affects blood composition, respiratory rate, appetite and eventually leads to poorer body condition score. But the well fed animals were very resistant to any kind of diseases when they grazed in the field or are kept at home. The fact that more tick burden was recorded in both local and exotic breeds compared to cross cattle. The current finding agree with the report by Belew and Mekonnen [24] who revealed that the presence of tick infestation in local breeds were very high with the prevalence of 44.96%, while in cross breeds and Jersey, the prevalence were 15.83%, and 8.50%, respectively. The significant variation in tick infestation of cattle of different breeds may be attributed to different management system, lack of supplementary feeding for local breeds, or lack of control measures against tick on local breeds. Furthermore, it can be assumed that it might be due to lack of interest of farmers for local breeds as well as taking more care to cross and exotic breeds than local breeds.

The male to female ratios of *B. decolaratus, A.varigatum, R. evertsi-evertsi, and A. cohaer* were similar to previous reports [31, 33]. Except *B. decolaratus*, all other species tick's males outnumbered females because males normally remain on the host longer than females. Fully engorged female tick drops off to the ground to lay eggs while male tend to remain on the host up to several months to continue feeding and mating with other females on the host before dropping off [31]. The females of *B. decolaratus* outnumbered males in this study probably due to small size of male which may not be seen during collection [23].

Conclusion and Recommendations

Variable information on tick species distribution and dynamics are very essential to assess the economic loss encountered due to tick infestation and also to identify the appropriate measure of tick control. Among ecto-parasites, ticks cause the greatest economic loss in livestock population either by transmitting a wide variety of tick-borne diseases or by affecting the health of animals as well as the quality of hide and skins. The important and abundant tick species investigated in the current study area were *B. decolaratus (45%), A.varigatum (23%), A. cohaerence (17%), and Rhipicephalus evertsi-evertsi (13%).* Different associated factors were also had contribution on abundance of tick at the area. In light of the above conclusion, the following recommendations are forwarded:

- Tick control program (application of acaricide) should be continued with an increasing frequency of application in wet months.
- Detection of acaricide resistance tick species which are economically important since limited types of acaricide were used in the area.
- Attention should be given to the selection of resistant cattle breeds and types, and good performance with regards to production of local breeds.
- Appropriate pasture management in communal grazing area is important.

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