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Prevalence and identification of major *Ixodidae* ticks, and their risk factors in cattle in and around Wolkite, South West Ethiopia

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Abstract

A cross sectional study was carried out from June 2019 to November 2019 in and around Wolkite town to determine prevalence of ticks, to identify major ticks infesting cattle, and to assess risk factors. Out of 384 cattle observed, 213 (55.5%) were found to be infested by one or more tick species. 1,019 adult ticks were collected from different body parts of the animals. Highest tick prevalence recorded was *A. variegatum,* with a prevalence of 47.5% (n=484) followed by *R. evertsi evertsi*, recording 30.1% (n=307), and *B. decoloratus* recording 22.4% (n=228) prevalence. Higher infestation of ticks was recorded in female animals (57.1%) as compared to male animals (53.3%) with no statistical significance difference (p=0.47, x^2=0.57). The prevalence was found to be statistically significant (p= 0.023, x^2=5.28) among the age groups, with highest prevalence in adult animals (58.8%) than young animals (45.2%). Higher positivity (68.1%) was revealed in cross breed cattle compared to (52.7%) in local breeds and was statistically significant (p=0.023, x^2=5.47). High prevalence was recorded in cattle with poor body condition, whereas low prevalence was recorded in cattle with good body condition. Higher prevalence was recorded in animals kept under extensive farming (63.8%) as compared to semi-intensive (11.5%) with statistical significance difference (p=0.000, x^2=56.82). Special attention should be given to the control and prevention of ticks in the study area.

Keywords: cattle, *ixodidae* ticks, prevalence, wolkite

Introduction

Ethiopia, located in the Horn of Africa, has an extremely diverse topography and 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 (CSA, 2015). 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, meat production and source of manure. Unfortunately, the contribution of this huge natural resource to human nutrition and export earnings is disproportionally low. The Ethiopian livestock

population contributes only 15% to the GDP. Cattle are a prime resource for the people and government of Ethiopia. Thecountry has the largest cattle population in Africa, estimated at 35 million head (CSA, 2013).

Ticks are ectoparasites of livestock, which are classified (together with mites) in the order Acari. All ticks are obligate ectoparasites of vertebrates. They have three pairs of legs in larvae and four pairs of legs as nymphs and adults, and the body is divided into the capitulum and the opisthosoma. There are atleast 840 tick species in two major families, namely the *Ixodidae* and *Argasidae*(Jongejan and Uilenberg, 2004). Ticks that are considered to be most important to domestic animals' health and production in Africa comprise about seven genera and forty species. Among these tick genera, the main ticks found in Ethiopia are *Ambylomma (*40%), *Rhipecephalus* (37%), *Boophilus* (21%), *Hyalomma* (1.5%), and *Heamaphysalis* (0.5%) (Minijauw and McLeid, 2003). Among these, *A. varigatum* and *B. decoloratus* are most important and widely distributed. *A. coherence, A.gemma, A. lepidium, H. marginatumrufipes, H. truncatum,* and *R. evertsi* are also commonly found in Ethiopia (Bariso and Worku, 2018).

Many risk factors are associated with tick infestation in farm animals (Sajid et al., 2011) which in turn has a direct impact on the epidemiology of zoonotic and non-zoonotic tick borne diseases (TBDs). The effect f environmental factors such as climate and habitat type on tick distribution patterns have been investigated in different parts of the world. Similarly, the effect of host characteristics has conferred various degrees of resistance to tick infestation (Berman, 2011). Therefore, identification of these risk factors could contribute a vital role in designing cost effective tick control measures.

Even though there are some studies on prevalence, and identification of ticks in other parts of Ethiopia, there is no information on prevailing tick species infesting cattle in and around Wolkite town. Therefore, relevant data on the distribution of ticks, different tick species and factors predisposing cattle infestation is essential for the development of effective tick and tick borne disease control strategies. Therefore this study was carried out to identify different tick species and their predilectionsites, determine prevalence and risk factors associated with tick infestations in the study area.

Various studies have been conducted in different localities of Ethiopia. The prevalence of the previous studies has shown a range of 23-85%. However, limited information has been made in the present study area. Therefore, the objectives of the present study were:-

- ❖ To estimate the prevalence of hard tick infestation on cattle in the study area.
- ❖ To identify the associated risk factors of tick infestation in the study area.
- ❖ To determine the burden of tick infestation in local and cross breeds of cattle.
- ❖ To identify the species of dominant ticks found in the study area.

Materials and Methods

Description of the Study Area

The study was conducted in Gurage Zone in and around Wolkite town, which is located 155 km from the capital city (Addis Ababa). The town has latitude and longitude of 8˚17'N 37˚47'E and an elevation between 1910 and 1935 meters above sea level (GZADD, 2011).

Study Population

Cattle found in and around Wokite town were the target animals. The livestock population of the area comprised about 11,641 cattle, 7,803 sheep, 3,009 goats, 1,196 equines and 162,015 poultry (GZADD, 2011). A total of 384 animals (local and cross breed) were randomly selected and examined, which are managed under extensive system. The age, sex, breeds and body condition scores of each animal was also recorded.

Sampling Design and Sampling Technique

A cross sectional study was conducted from June, 2019 to November, 2019 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

Sample Size Determination

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 by using the formula given in Thrusfield (2005). The expected prevalence of *Ixodidae* ticks of cattle in Wokite town 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

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

Where n = sample size; Pexp = expected prevalence; d^2 = expected precision which is usually 5% (0.05).

Methods of Data Collection

Firstly, the selected study animal was properly restrained and all tick samples were collected from half the body regions. Ticks were removed carefully and gently in a horizontal pull to the body surface. The collected ticks were preserved in universal bottles containing 70% ethanol and labeled with respect to predilection site, age, sex and date of collection, then transported to Wokite town Veterinary Clinic 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*., (2003).

Data Analysis

The data were entered and managed in Microsoft-excel sheet. SPSS 21.0version software program 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 ($\chi 2$) test was used to assess the association in tick infestation between different variables. Effects were reported as statistically significant in all cases if p value is less than 5% ($p< 0.05$).

Results

Overall Prevalence

Out of the 384 animals examined, 213 cattle were found infested with three species of ticks infestation. The overall prevalence of tick infestation recorded in and around Wolkite town was 55.5%. (Table 1)

No. of animal examined	No. of positive animals	No. of negative animals	Prevalence (%)
384	213	171	55.5

Table 1 Prevalence of *Ixodidae* ticks in and around Wokite

Identification of Tick on Species Level

A total of 1,019 *Ixodidae* tick species were collected from different body parts of 213 tick infested cattle. Three different tick species were identified and these were *A. variegatum* (47.5%), *R. evertsi evertsi* (30.1%), and *B. decoloratus* (22.4%). (Table 2)

Name of tick genera	No. of positive animals	No. of adult ticks collected	Prevalence (%)
A. variegatum	102	484	47.5
R. evertsi evertsi	64	307	30.1
B. decoloratus	47	228	22.4
Total	213	1019	

Table 2 Distribution of *Ixodidae* tick genera in and around Wokite

Prevalence by Sex and Age

The prevalence of tick infestation in the present study revealed that the occurrence of tick in both sex of animals were not significantly different (p=0.47) in which 57.1% of female animals and 53.3% of male animals examined were infested by ticks (Table 3). According to the present study findings, there was statistically significant association between age of the animals and level of tick infestation (p=0.023) in which 45.2% of young animals and 58.8% of adult animals examined wereinfested by ticks. (Table 3)

Name of tick genera	No. of animal examined	No. of positive animals	Prevalence (%)	P – value	X^2
Sex					
Female	217	124	57.1	0.45	0.57
Male	167	89	53.8		
Age					
Young	93	42	45.2	0.022	5.28
Adults	291	171	58.8		

Table 3 Prevalence of tick infestation in cattle by sex and age

Prevalence by Breed and Body Condition

The study on tick prevalence conducted on 384 cattle consisting of 315 local breeds and 69 cross breeds revealed higher positivity (68.1%) in cross breed cattle compared to (52.7%) in local breeds. The occurrence of tick infestation based on breeds of cattle was statistically significant p=0.023. (Table 4). Based on the body condition of the animals, high prevalence of tick infestation was recorded in cattle with poor body condition, whereas low prevalence was recorded in cattle with good body condition. This study detect a significant difference (p=0.000) in prevalence of the different tick species among the three categories of animal body conditions scores. (Table 4)

Name of tick genera	No. of animal examined	No. of positive animals	Prevalence (%)	P – value	X^2
Breed					
Local	315	166	52.7	0.02	5.45
Cross	69	47	68.1		
Body condition					
Poor	98	74	75.5	0.000	45.84
Medium	181	108	59.7		
Good	105	31	29.5		

Table 4 Prevalence of ticks in cattle by breed and body condition

Prevalence by Management system

The prevalence of tick infestation in the present study revealed that the occurrence of tick in both systems of management were significantly different (p=0.000) in which 63.8% of animals kept under extensive management system and 11.5% of animals kept under semi-intensive management system were infested by ticks (Table 5).

Name of tick genera	No. of animal examined	No. of positive animals	Prevalence (%)	P – value	X^2
Management system					
Extensive	323	206	63.8	0.000	56.82
Semi-intensive	61	7	11.5		

Table 5 Prevalence of ticks in cattle by management system

Prevalence by Predilection Sites

It was revealed in this study that three different tick species have different predilection sites. According to this result, *A. variegatum* had strong preference for udder or scrotum (19.8%), and perineum (16.1%). *R. evertsi evertsi* was highly prevalent on udder or scrotum followed by (23.1%) dewlap (16.6%) and ear (15.9%). Genus *B. decoloratus* was highly found attached to udder or scrotum (21%) and followed by ear (15.8%) and dewlap (14%). Generally, higher numbers of ticks were attached to udder or scrotum (21.1%) which followed by ear (13.5%) and dewlap (10.4%).(Table6).

Predilection Sites of ticks	*A. variegatum* (%)	*R. everts ievertsi* (%)	*B. decoloratus* (%)	Total (%)
Ear	53 (10.9)	49 (15.9)	36 (15.8)	138 (13.5)
Neck	45 (9.3)	33 (10.7)	28 (12.3)	106 (10.4)
Dewlap	48 (9.9)	51 (16.6)	32 (14)	131 (12.8)
Brisket	39 (8)	24 (7.8)	28 (12.3)	91 (8.9)
Abdomen	40 (8.2)	13 (4.2)	4 (1.8)	57 (5.6)
Udder/Scrotum	96 (19.8)	71 (23.1)	48 (21)	215 (21.1)
Perinium	78 (16.1)	18 (5.9)	12 (5.3)	108 (10.6)
Anno-vulva	41 (8.4)	27 (8.8)	21 (9.2)	89 (8.7)
Under tail	44 (9.1)	21 (6.8)	19 (8.3)	84 (8.2)
Total	484 (47.5)	307 (30.1)	228 (22.4)	1019 (100)

Table 6 Ticks and their attachment sites

Discussion

This study revealed that *ixodidae* ticks are widespread and most significant external parasites of cattle in the area with an overall 55.5% prevalence that were found to be infested with at least a single tick or more. This finding is relatively in line with previous findings reported by (Meseret *et al*., 2017) who found 59.6% % in Harar region, Eastern Ethiopia, and (Bemrew *et al*., 2015) who found 56.2% in Dangila District, Awi Zone, North West Ethiopia. (Getachew *et al*., 2014) in Northwest Ethiopia, and (Eshetu *et al*., 2016) in Gambella town reported 81.25% and 89.58% prevalence respectively which is higher than the current work. The result is in line with a finding in Humbo by (Pawlos and Derese, 2013) and Wolayita Sodo by (Ammanuel and Abdu, 2014) in which they found overall prevalence of 61.98% and 65.5% respectively. The highest prevalence of the tick infestation (97.8%) was reported by (Mesele *et al*., 2010).

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). In the present study *Ambylomma variegatum* was found to be the most abundant tick species in and around Wokite town (47.5%). Similarly, (Bariso an Worku, 2018) in WsetArsi Zone, (Meseret *et al*., 2017) in Harar region, Eastern Ethiopia and (Bemrew *et al*., 2015) in Dangila district, Awi Zone, North West Ethiopia reported a 46.1%, 38.5% and 37.5% prevalence of *Ambylomma variegatum* respectively. However, reports from different parts of Ethiopia such as (Gurmessa *et al*., 2015) in Sebeta town, (Kumisa*et al*., 2017) in West Shoa Zone and (Tsegaw *et al*., 2015) in Eastern Hararaghe indicated lower prevalence of *Ambylomma variegatum* in the respective study areas reporting 22.9%, 26.6% and 28.4% prevalence respectively. *Rhipicephalus evertsi evertsi* was the second most prevalent tick species of cattle in the study area (30.1%). Similar to our study,(Meseret *et al*., 2017)reported 29.9 % prevalence of *Rhipicephalus evertsi evertsi* in Harar region, Eastern Ethiopia. However, reports from different parts of Ethiopia such as (Kumisa *et al*., 2017) in West Shoa Zone (3.6%), (Fanos *et al*., 2012) in Mizan Teferi (12.3%), and (Kebede et al., 2018) in West Wellega Zone (14.8%) indicated lower prevalence from the present study; and report from (Gurmessa *et al*., 2015) in Sebeta town (53.4%) indicated higher prevalence from the present study. According to (Morel, 1980), the native distribution of *Rhipicephalus evertsi evertsi* in Ethiopia is likely to be connected with middle height dry seasons and steppes in association with abundant ruminant populations. In addition, (Pergam *et al*., 1981) stated that this tick species shows no apparent preference for particular altitude, rainfall zones or seasons which might have contributed to its wide distribution. The prevalence of *Boophilus decoloratus* was 22.4% and it was the least tick species in abundance in the study area. (Meseret *et al*., 2017) and (Kebede *et al*., 2018) reported almost the same level of prevalence in Harar region (20.8%) and in Weste Wellega Zone (23.2%) respectively. In general, the results of the study were similar to the reports of from many other parts of Ethiopia such as in Rift Valley region of Ethiopia (Stachurski, 2000) and in Bale (Dejenu, 1988). *Boophilus decoloratus* is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually (Pergam *et al*., 1981).

Male animals were found slightly less affected than female counter parts (in male 53.3% and in female it was 57.1%). This result is concurred with the results of (Tesfaheywet and Simeon, 2013; Kassa and Yalew, 2012) in Chilga District, Northwest Ethiopia and in and around Hararamaya district, Eastern Ethiopia respectively. This might be due to equal opportunities of oxen and cows to tick infestation in their production as well as in their management condition.

The proportion of tick infestation in cattle in the study area was higher in adult animals than young animals. This result agrees with reports by (Kumisa*et al*., 2017; Tesema and Gashaw, 2010); Tiki and Addis, 2011) in Dandi district, West

Shoa Zone, in and around Asela town, South East Ethiopia, and in and around Holeta town, Ethiopia respectively, who reported a higher proportion of tick infestation in adult cattle than the youngerones. A relatively higher proportion of infestation in adult may be due to outdoor management and long distant movement of adult animals to search for food and water as compared to younger animals, so the chance of exposure is higher (Pawlos and Derese, 2013) in Humbo district, Southern Ethiopia. Cross breeds (68.1%) were affected more than the local breeds (52.7%) This result was disagreed with the findings of (Kassa and Yalew, 2012) in and around Hararamaya district, Eastern Ethiopia, who reported the prevalence of tick infestation higher in local breed cattle (58.18%) than cross breed ones (10.55%). The finding in the present study agrees with the findings of (Tamiru and Abebaw, 2010) in and around Asella town, southeast Ethiopia in that the prevalence of ticks was higher in the cross breeds than local breeds. The prevalence of ticks was 75.5%, 59.7% and 29.5% in poor, medium and good body condition scores. Similar finding was indicated in (Bossena and Abdu, 2012)in and Around Assosa Town, Ethiopia. The higher prevalence of ticks in the poor body condition scores than other counter parts could be due to the less resistance of weak animals to ticks infestation.

Tick infestation was significantly higher in cattle kept under extensive farming system (63.8 %) as compared with semi-intensive farming system (11.5%) and this finding is in agreement with the findings of (Kumisa*et al.*, 2017) in Dandi district, West Shoa Zone. This might be attributed to the currently existing modified animal husbandry practice where animals are kept most of the time indoor with semi-intensive care. Therefore, the chance of occurrence of tick infestation in extensive farming system is greater than semi intensive farming system. 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, *Ambylomma variegatum* had strong preference for scrotum/udder (19.8%), and perineum (16.1%) whereas *Rhipicephalus evertsi evertsi* highly prefer udder/scrotum (23.1%), dewlap (16.6%), and ear (15.9%). *Boophilus decoloratus* was highly found attached to udder or scrotum (21%) and followed by ear (15.8%) and dewlap (14%). Generally, higher numbers of ticks were attached to udder or scrotum (21.1%) which followed by ear (13.5%) and dewlap (10.4%). The result of this study is in line with the results of (Solomon and Kassa, 2001) 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 (Hoogstraal, 1956; Tiki and Addis, 2011).

Conclusion and Recommendations

According to the present result, 55.5% overall prevalence of tick was observed in the study area. In this study *Ambylomma variegatum* was found to be the most abundant tick species (47.5%) and the least was *Boophilus decoloratus* (22.4%). Three tick species were identified in the study area. The prevalence on sex bases illustrated that it is higher for females than males. The prevalence rate based on age of the animal also showed that adult animals are more affected than young animals. The result indicates higher prevalence of ticks in the area. This may result in huge loss in hide and skin loss, body weight loss and other economic important factors. Therefore, based on the above conclusion the following recommendations are forwarded:

❖ Effective tick control program should be formulated and implemented based on the distribution pattern of ticks and factors responsible for their destruction.

❖ Appropriate pasture management in communal grazing area should have to be given a consideration.

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