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Prevalence of Ixodid Ticks in Small Ruminants in and Around Jimma District

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ABSTRACT: *A study on small ruminants' tick was conducted in and around Jimmatown, Southwest Ethiopia, from November 2017 to April 2018 with the objectives of determining the tick infestation prevalence and identifying the common genera of hard ticks in indigenous breeds of small ruminants (sheep and goats). The study was conducted using cross-sectional design to assess the adult ticks attached on study animals. A total of 350 animals (299 sheep and 51 goats) were examined. From the total examined animals, 118 of them were found to harbour different tick genera, giving an overall prevalence of 33.7% (95% CI: 26.7- 38.9). The prevalence of tick infestation in goats and sheep was found to be 35.1% and 23.1 %, respectively. The prevalence of tick infestation between two age groups of animals were statistically insignificant (P>0.05). However, the prevalence was higher in young (53.3%) than adult (29.2%). The prevalence found to be statistically insignificant within species of small ruminants (P>0.05). In this study, six genera of ticks were identified, with the following abundance among tick infested animals:Hyalomma(36.4%),Amblyomma(34.7%), Boophilus(22%), Ixodes6.7%) , Haemaphysalis(4.2%), and Reipicephalus (1.6%).The Preferred attachment sites for most of tick genera identifiedwere internal part of legs, scrotum/udder and anogenital in decreasing order. In conclusion small ruminants' ticks infestation is highly prevalent in the study area. Therefore, attention should be given to the control and prevention of ticks and further study should be done to assess the seasonal dynamicity of ixodid ticks and tick borne diseases of small ruminants in the study area.*

KEY WORDS: *Genera, Goat, Hard tick, Jimma, Sheep, surve*

INTRODUCTION

Ethiopia is endowed with a very large and diverse livestock resource including sheep and goats, the country do have 29.33 million sheep, and 29.11 million goats (CSA, 2016).These small ruminants play a significant role in socio- economic life of the people of Ethiopia (Minjauw*et al*., 2003).Sheep and goats account for 40% of cash income and 19% of the household meat consumption (Zelalem and Fletcher 1993).Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep, and goats are considered as investments and insurance to provide income to purchase food during seasons of crop failure and to meet seasonal purchases such as improved seed, fertilizer, and medicine for rural households.Hides and skins accounts for 12-16% of the total value of exports in Ethiopia (Minjauw*et al*., 2003a).

The current utilization of hides and skins in Ethiopia is estimated to be 45% for cattle hide, 75% goatskin, and 97% sheep skin with expected off take of 33, 35, and 7% for sheep, goats, and cattle, respectively. However, in recent years, this rank has been relegated to fifth level mainly because of rejection and down grading inflicted on hides and skin defects mainly due to infestation by external parasites (Kassa, 2006).Among the ectoparasitic infestations, ticks remain one of the most economically important parasites of livestock's in tropical and subtropical countries (Jongejan And Uilenberg, 1994). Ticks rank second to insects as vectors of transmissible diseases in man and animals (Opara2016 and Ezeh, 2011). (Bowman *et al.*, 1996) estimated.

more than 80% of world livestock population was infested by ticks, which were known to transmit viral, bacterial and protozoan pathogens causing Tick Borne Diseases (TBD) such as hemorrhagic fever, anaplasmosis, theileriosis and babesiosis (Rajput *et al.,* 2006). [19]Production losses due to ticks and tick-borne diseases (TBD) around the globe were put at US$ 13.9 to US$ 18.7 billion annually (De Castron*et al.*, 1997).

In Ethiopia there are a lot of reports on the status of hard tick in small ruminants in different part of the country. For example several species of ticks belonging to genus *Amblyomma, Boophilus,Rhipicephalus, Hyalomma and Haemaphysalis* have been reported. Among these tick genera, the main ticks affecting small ruminants reported in Ethiopia were *Amblyomma (40%), Boophilus (21%),Haemaphysalis(0.5%), Hyalomma (1.5%), and Rhipicephalus (37%)* in different part of Ethiopia (Jafer*et al*.,2017), (Asmare*et al* .,2012), (Serste and Wossen 2007).There are currently no studies on the prevalence and genera of ticks commonly affecting sheep and goats production in and around Jimma town, despite the fact that Jimma area is endowed with favorable weather condition suitable for the proliferation of ticks, thus the objectives of the study were:

- ✓ To determine the prevalence of tick infestation in small ruminants in the study area
- ✓ To identify the genera of ixodide ticks affecting sheep and goats

MATERIALS AND METHODS

Description of study area

The study wasconducted from November 2017 to April 2018at Jimma town of Oromia Regional State south-western Ethiopia and jimmaUniversity College of agriculture and veterinary medicine (JUCAVM). Jimma town islocated at 355km south-western of Addis Ababa, liesbetween 360^{0C} 10´ E longitudes and 70 40´ N latitude an elevation ranging from 880 to 3360 meters above sealevel (JZMSR2004). Very currently Jimma Zone is divided in to 17districts (hosting a total population of over 2.4million, (CSA2008). The area is characterized by a humid tropicalclimate of heavy annual rainfall that ranges from 1200-2000highlands (15%), midlands (67%) and lowlands (18%) mm per year. About 70% of the total annual rainfall is received during rainy season, which lasts from the end of May to early September. The mean annual maximum and minimum temperature ranges from 25°C-30°C and 7°C-12°C, (OPEDJZ,2002).

Study population

The study population comprises of local breeds of sheep and goats managed under extensive grazing system of both sex (male and female) in different Kebeles of Jimma town

Study Design

The study design was cross-sectional study, which was to assess the adult tick present in the bodyof small ruminants in the area

Study Methodology

Presence and absence ticks in the body of examined was done on the field, then adult ticks collection was done for identification of tick genera infesting sheep and goats.

Tick collection and identification

Adult ticks were collected from whole body regions of small ruminants into universal sample bottle containing 70% ethanol (Okello-Onen*et al*., 1999[a] and Walker *et al*., 2003). The body regions used for collections were head, neck, brisket, belly, udder/ scrotum, Anogenital region, leg and tail (Kaiser*et al*., 1982). Ticks were removed from the host skin whilst retaining their good condition for identification using good quality steel forceps. The collected adult ticks from each body regions were kept separately for identification in separate sample bottles. Then ticks transported to Jimma University, school of veterinary medicine, Veterinary parasatology laboratory. And identified using stereomicroscope following,in the laboratory the ticks collected were examined by seterio microscope. The morphology of the ticks was studied. Identification of the different genera of the ticks was accomplished with the help of the anatomical and morphological characteristics as described by (Okello-Onen*et al*., 1999[a]) and (Walker *et al*.,2003). During the collection time species (ovine/caprine), sex, age (young and adult) and body condition (Poor, Medium and Good) of animals were recorded.

Sampling and sample size

Examined animals were selected by systematic random sampling technique for ticks collection and identification from eight half-body regions of sheep and goats: Head, neck, Brisket, Belly, Udder or Scrotum, Anogenital, Leg and Tail Since there was no study conducted so far in Jimma town to determine the prevalence of tick infestation of small ruminants, as well as to get the maximum sample size (384), we considered an estimated prevalence of 50%, with 95% confidence interval and 5% absolute level of precision were considered according to the formula given by (Thrusfield 2005).

$N= (1.96)^2 Pexp(1-Pexp)/d^2$

Where: N=Sample size, Pexp= Expected prevalence (50%) and d = desired level of precision (5%). However a total 350 (299 sheep and 51 goats) animals were examined. A greater number of sheep was sampled because of their predominance in the area

Data Management and Analysis

The information obtaining from clinical examination, laboratory test and observation was entered on spreadsheet of Microsoft Excel. The data was screened for errors and coded before subjected to statistical analysis. Descriptive statistics used to analyze the data and percentages and tables were used to describe the results. To test the various risk factors associated with tick infestation, Chi-square test was used by using the Statistical Package STATA 11. In all the analyses, confidence level was held at 95% and $p< 0.05$ was considered as significant.

RESULTS

Overall prevalence of ectoparasites

From 350 small ruminant examined, 118 were infested by one or more genera ticks with an overall prevalence of 33.7% (95% CI: 26.7- 38.9).The overall tick infestation prevalence recorded in the male and female small ruminants of both species was 34.2% and 33.1% respectively, with no statistical significance variation (Table). Higher the tick infestation rate was observed in young (53.3%) small ruminants than adult (29.2 %) small ruminants, however the difference was not statistical significance ($P > 0.05$)

The overall prevalence of tick among sheep and goats were 35.1% (105/299) and 23.5% (12/51), respectively and nostatistical significance variation was observed (Table1).

Table 1: Overall small ruminant's prevalence of tick infestation by sex, age and species ofand animals examined

Variable	No. of examined	No positive	Prevalence (%)	95%CI	X^2	P-value
Sex						
Male	184	63	34.2	27.3- 41.6	0.47	0.827
Female	166	55	33.1	26.1- 40.8		
Age						
Young	13	7	53.3	25.1- 80.7	2.44	0.118
Adult	337	111	32.9	27.9- 38.2		
Species						
Ovine	299	105	35.1	29.7- 40.8	2.77	0.09
Caprine	51	12	23.5	12.7- 37.5		

Prevalence of tick genera in small ruminants (sheep and goats)

During the study period six genera of different types of ticks were identified which are *Amblyomma, Hyalomma, Boophilus, Haemaphysalis, Ixodes*and *Rhipicephalus.*The overall prevalence the six genera of ixodide ticks among the small ruminants is depicted in table 2: The highest infestation was caused by Hyalomma (12.3%)followed by *Amblyomma* (11.71%),*Boophilus*(7.43%),*Ixodes*(2.3%),*Haemaphysalis*(1.2%) *and Reipicephalus.*(0.57%).

Table2: The overall prevalence of genera of ticks identified in small ruminants (n= 350)

Genera of ticks	Number of positive animals	Prevalence (%)	95% CI	Chi-square, p-value
Amblyomma	41	11.71	8.8- 15.5	
Boophilus	26	7.43	4.5- 10.7	
Haemaphysalis	5	1.2	0.5- 3.3	75.4, 0.000, Df* = 5
Hyalomma	43	12.3	9.1- 16.2	
Ixodes	8	2.3	0.9- 4.4	
Reipicephalus	2	0.57	0.06- 2.1	

- Df : Degree of freedom

4.3. The proportion of genera of tick infestation in infested animals

Out of all infested animals (n=118), the proportion of infection percentage by the six genera of tick indentified and mixed infestation with more than one tick species is depicted in figure 4, 14.5% of infested animals were found to have a mixed infestation with more than one tick genera (figure 4).

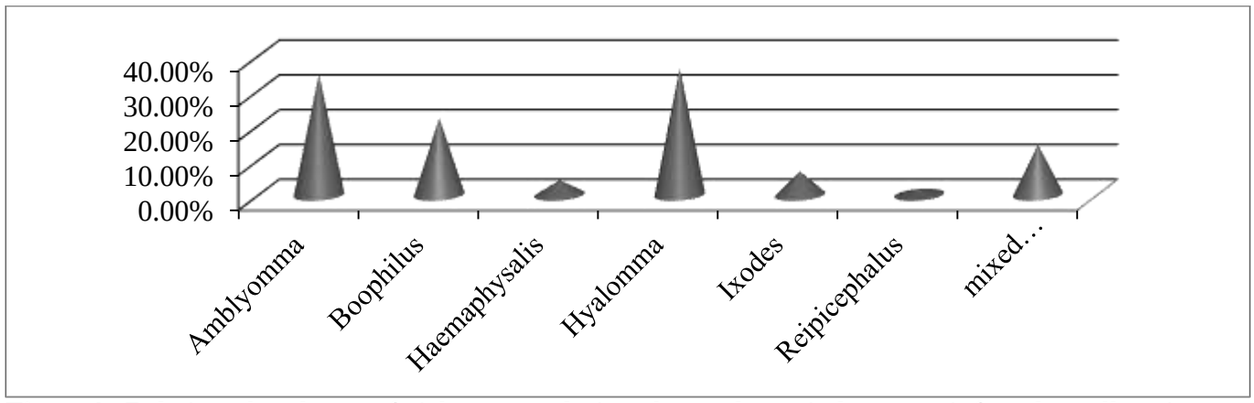

Figure4: Relative abundance of tick genera during the study period among infested smallruminants (n=118)

Assessment of genera of tick attachment sites

Each species of tick consistently favored various body regions of small ruminants (sheep and goats), but the preferences were stronger in some genra than others. The observed proportion of tick genera attachment sites during this study was summarized and shown on table 3.The most preferred predilection sites of all *Amblyomma*genera identified during this study was legs followed by scrotum, udder, anogenital, tail and head in decreasing order of preference. *Boophilus preferred* attachment sites in decreasing order were legs and brisket. During this study periods identified *Hyalomma*species were found primarily attached to legs and secondarily on scrotum or udder*Haemaphysalis and Reipicephalus*mainly attached on legs(Table3).

Table3.Summary of the attachment sites percentages of the most common tick genera among infested small ruminants in the study areas

Body regions						
Tick genera	Head Including ear	Brisket	Scrotum/ udder	Tail	Anogenital	Leg+interdigital space
Amblyomma(n=41)	1(2.4%)	-	7(17.1%)	3(7.3%)	4(9.7%)	25 (60.1%)
Boophilus (n=26)	-	3(11.%)	-	3(11.5)	2 (7.6%)	18(69.2%)
Haemaphysalis (n=5)	-	-	1 (20%)	-	1(20%)	3 (60%)
Hyalomma (n=43)	1(2.3%)	2(4.6%)	3(6.8%)	-	1(2.3%)	37(86%)
Ixodes (n=8)	1(12.5%)	-	1(12.5%)		1(12.5%)	5(62.5%)
Reipicephalus(n=2)	-	-	-	-	-	2 (100%)

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DISCUSSION

The overall prevalence of tick infestation (33.7%) reported in this study is relatively moderate when compared to other reports from other areas of Ethiopia, for example the current finding was in agreement with the previous overall tick infestation prevalence report of 31.4% in and around Bahirdar town (Tesfaye*et al.,* 2012). However a higher overall prevalence small ruminant tick infestation were reported elsewhere in this country; for instance 79.7%(Kedir and Petrose, 2015), 76.5% (Fufa*et al*., 2012) and 72.4% (Abebe*et al.,* 2017) were reported in and around Bedele town, Fafen zone in Ethiopia Somali region and in and around Dire Dawa town. Relatively lower overall small ruminate tick infestation, which is 20% was reported in and around Gonder town (Fentahun*et al.,* 2012) when compared with our finding. The difference in the prevalence might be due to the geographical difference, breed difference of the study animals and season of the study period.

The overall prevalence recorded in sheep (35.1%) and goats (23.5%). this study was close to the study conducted in and around Bahir Dar (Asmare*et al*., 2012)recorded an over prevalence of37% in sheep and 23.9% in goats, similarly an overall prevalence of 21.2% and 17.1% in sheep and goats were recorded in and aroundGonder town(Fentahun*et al*., 2012). Additionally (Yacob*et al*., 2008) reported very similar overall tick infestation prevalence in sheep (31.7%) and goat (18.3%) in WolayitaSodo,

On the contrary the overall tick infestation rate recorded in sheep and goats in this study was lower than the reports done by (Seyoum*et al.,* 2015) n Miesso district, Western Hararghe, who recorded a prevalence of 87.5 % (goats) and 89.9 % (sheep), (Eyob and Matios2014) recorded a higher prevalence of 97.58% (goats) and 69.86%(sheep) in Dhas district of Borana pastoral area, Southern Rangelands of Ethiopia. Additionally, 66.12% (goats) and 80.30% (sheep) over all prevalence was recorded in Bedelle district, Oromia Region, Ethiopia (Fufa*et al*., 2012). Environmental variations and differences in the time of year when the study was conducted could also contribute to differences in the prevalence of tick infestation in various areas of the country as temperature and relative humidity are the major ecological determinants for the reproduction and growth of tick populations (Latif and Walker, 2004).

The overall prevalence of tick in different age and sex groups of examined small ruminantwas show no statistical significant variations ($P > 0.05$). Even if there were no statically significant variations in young and adult animals examined in this study, the recoded prevalence in young animals (53.3%) seems large when compared with adult animals (32.9%). in contrary to this report (Fentahun*et al*., 2012 and Abebe*et al*., 2017) observed asignificantly higher prevalence ($P < 0.05$) in adult animals in their study in and around Gonder and Dire Dawa towns respectively.

The overall prevalence between male and female was statistically insignificant ($P > 0.05$), this finding is in agreement with the study conducted in three districts of Fafen Zone in Somali Regional State, Eastern Ethiopia (Kedir and Petros, 2015). On the contrary the current findings, (Abebe*et al*., 2017) observed a statistically significant high prevalence in female small ruminants in their study. This study revealed the presence of six genera of hard ticks namely: *Amblyomma, Hyalomma, Boophilus, Haemaphysalis, Ixodes*and *Rhipicephalus.*These all indicates that the bionomic situation of the study area is favorable for the successive perpetuation of the pathogens transmitted by ticks and for their subsequent transmission to susceptible host.

In the present study, *hyalomma*had the highest frequency among the collected tick species in small ruminant (sheep and goats), the finding is in agreement with the previous studies done in different areas of Ethiopia (Kedir and Petros; 2015; Abebe*et al*., 2017). The least frequent genera of tick during the study period was *Rhipicephalus*(0.57%), similar find was reported in Arsi Area (Hailegebriel*et al*., 2015).In general the finding of different genera of ticks in and around Jimma indicates the epidemiological significance in transmission of tick borne diseases such as anaplasmosis, babesiosis and ricketsial diseases.

The most preferred predilection sites of all *Amblyomma*genera identified during this study was legs followed by scrotum or udder, anogenital, tail and head in decreasing order of preference. *Boophilus*preferred attachment sites in decreasing order were legs and brisket. During this study periods

identified *Hyalomma*species were found primarily attached to legs and secondarily on scrotum or udder.*Haemaphysalis*and*Reipicephalus*mainly attached on legs.The result of this study showed that the predilection sites of ticks over the body of small ruminants was high on legs, specifically in the interdigitalspaces between hoof, this impair productivity and mobility of the small ruminants (Sheep and goats).

CONCLUSION AND RECOMMENDATIONS

From this study result it is possible to conclude that the overall prevalence of tick infestation in sheep and goats is relatively high. Sex, age and species of small ruminant were not principally determinants in the overall tick infestation prevalence in the study area. Among the tick genera identified in the study areas the most abundant were *Hyalomma,Amblyomma and Boophilus.*The Preferred attachment sites for most of tick genera identifiedwere internal part of legs, scrotum/udder and anogenital in decreasing order. Therefore the following recommendations were put forward

- Strategic tick control: Application acaricides aimed at reduction of ticks population based on information about their seasonal activity.
- Integrated tick control: These encompasses biological, chemical and ecological control methods, should be used
- Extension work: Educating animal owners on the problems of tick, and the different control methods, which can be available in their areas. Successes of ticks control generally associated with good extension work.
- Tick-borne diseases assessment: Importance, distribution, and seasonal prevalence of tick borne survey should be conducted.

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Annexes

Annex 1: Sample collecting format

Animal no	Animal Ssp	Breed	Sex	Age	Site of adult tick	Adult tick	TickSpp	Lab. Result

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Annex 2: Estimated age for sheep and goats with different numbers of erupted permanent incisors

No. of permanent incisors	Estimated age range	
	Sheep	Goat
0 pair	Less than one years	Under 1years
1 pair	1-1½ years	1-2 years
2 pair	1½-2years	2-3 years
3 pair	2½-3years	3-4 years
4 pair	More than 3 years	More than four years
Broken	Aged	Aged

Source :(vatta*et al*., 2006)

Annex 3: Tick identification procedure

✓ Ticks were removed from host skin carefully, not to damage the mouth parts, horizontally to the animal.

✓ Code is given for ticks collected from each body regions with respect to date, site of attachments, their respective sex, age and breedof the animal.

✓ The sample was put in universal bottle containing 70% ethanol and then it was transported to regional veterinary laboratory for identification purpose.

✓ Ticks were identified to the genera and species level using stereomicroscope based on tick identification keys of (Kaiser, 1987 andMethyscae 1987).

✓ Ticks were usually identified by the shape and length of capitulam, the colour of the body, the shape and markings on the scutum, host preferences and location on the host. Male and unengorged female ticks were easier to identify than engorged female ticks (Hendrix, 1998).

Annex; 4 Materials General Equipment

✓ White coveralls
✓ Boots,
✓ Datasheet
✓ Bag transporting tick samples
✓ Pencils and permanent marker pens for collection vials
✓ Thermometer (preferably digital)
✓ Mobile phone (optional)
✓ Forceps
✓ Magnifying glass to see ticks easier (optional)
✓ Garbage bags (to contain used drag cloths, coveralls, etc.

DECLARATION

I, the under signed, declare that the information presented here in my thesis is my original work, has not been published and not under consideration of publication in any journals and that all sources of materials used for this research have been duly acknowledged

Name: Mujahid Jewaro andKufa Mustefa