European Journal of Applied Sciences 7 (2): 50-55, 2015
ISSN 2079-2077

DOI: 10.5829/idosi.ejas.2015.7.2.9471

Prevalence of Ixodid Ticks in Small Ruminants in Selected Districts of Fafen Zone, Eastern Ethiopia

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Abstract: A cross-sectional study was conducted from November 2014 to February 2015 to determine the prevalence of tick infestation in small ruminants in three districts of Fafen Zone in Somali Regional State, Eastern Ethiopia. A total of 384 small ruminants (186 Sheep and 198 goats) were selected and a total of 2441 visible adult ticks were collected from the body of both goats and sheep. In this study, seven species of ticks grouped under four genera were identified. The species identified included: *Rhipicephalus evertsi evertsi* (34.9%), *Hyalomma truncatum* (29.7%), *Rhipicephalus pulchellus* (21.6%), *Amblyomma variegatum* (21.4%), *Hyalomma rufipes* (16.7%), *Rhipicephalus (Boophilus) decoloratus* (11.2%) and *Amblyomma gemma* (2.1%). From the total examined animals, 306 (79.7%) were found to harbor different tick genera. Overall prevalence of tick infestation in three districts of study areas were 82.1%, 80.7% and 67.4% in Bombas, Fafen and Jigjiga, respectively. The prevalence of tick infestation in goats and sheep was found to be 77.8% and 81.7%, respectively. The prevalence of tick infestation between age and body condition of animals were statistically significant ($P<0.05$). It was higher in adult (88.5%) and old (83.1%) than young (36.8%) and higher in poor (89%) and medium (87%) body condition than good (74.9%) body condition. But the prevalence found to be statistically insignificant within sex and species of small ruminants ($P>0.05$). Generally ticks are 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: Sheep and Goats · Survey · Tick infestation

INTRODUCTION

In Ethiopia there are about 38 million cattle, 30 million small ruminants, 1 million camels, 4.5 million equines and 40 million poultry [1]. Agriculture employs over 80% of the livestock population and account for 45% of the gross domestic product (GDP) and 85% of the export earnings in the country. Small ruminants constitute about 30% of the total livestock population of Ethiopia. Small ruminants are important contributors to food production in Ethiopia, providing 35% of meat consumption and 14% of milk consumption [2].

The agricultural sector is characterized to a large extent by mixed farming system in which livestock play a vital role in the farming system of the country. In Ethiopia where mixed crop livestock production system is practiced, small ruminants account for 40% of cash income and 19% of the household meat consumption. 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 [3].

More than 850 species of ticks exists in the world, from this 60 different species of ticks are found in Africa. In Ethiopia, there are 47 species of ticks found on livestock and most of them have importance as vector and disease causing agents and also have damaging effect on skin and hide production. In Ethiopia, ticks and tick borne diseases cause considerable losses to the livestock economy, ranking third among the prevalent of parasitic diseases, after trypanosomes and endoparasitism [4].

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Diseases that are caused by ticks have the greatest economic losses in livestock production and are widely distributed throughout the world particularly in tropical and subtropical countries, which cause a tremendous economic importance in livestock production [5]. It has been estimated that 80% of the world's ruminants are infested by ticks and the production of over 1000 million ruminants (cattle, sheep and goats) around the world is affected. The introduction of exotic breeds with high productivity to different administrative regions in Ethiopia revealed that ticks are important vectors of several fatal diseases of animals. Ticks are common in all agro ecological zones of the country [6].

Ticks are directly or indirectly involved in causing substantial financial losses to livestock industry of Ethiopia accounts for 75% of the animal exports. A conservative estimate of 1 million birr loss annually was made through rejection and down-grading of hides and skins in Ethiopia [7]. The current utilization of hides and skins in Ethiopia is estimated to be 45% for cattle hide, 75% goat skin 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 [8]. Lamb skins are particularly susceptible to skin damage. Secondary bacterial infection of the bite increases the severity of the damage. Skin injuries can attract blowflies and screwworm flies that deposit eggs on the wound and produce a fatal, cutaneous myositis [9].

Ticks are responsible for severe losses directly by blood sucking and indirectly by disease transmission [10]. Tick bite may be directly debilitating to domestic animals, causing mechanical damage, irritation, inflammation and hypersensitivity and, when present in large numbers, feeding may cause anemia and loss of production. Some species cause tick paralysis and the others will elaborate toxins other than those causing paralysis. Heavy tick burden cause sufficient worry to interfere with feeding which may lead to loss of production and weight gain [11]. In contrast to this huge economic loss caused by ticks, some of the farmers in the Fafen Zone neglected ticks as animal health problem, most of them have little knowledge about effect of tick on their small ruminants and none of them know diseases transmitted to domestic animals by ticks. Even though different studies were done on camel ticks, cattle ticks and other domestic animals in the Eastern part of the country, little attention was given to that of small ruminants especially in the study area. Moreover, there was not specific study conducted on status of tick infestation on small ruminant in the study area. Therefore, the objective of the study aims at conduct a survey on tick infestation of small ruminants in selected districts of Fafen Zone.

MATERIALS AND METHODS

Study Area: The study was conducted in three districts (Bombas, Fafen and Jigjiga) of Fafen Zone of the Somali Regional State, which is situated in the eastern part of the country at 4° to 11° North Latitude and 40° to 48° East Longitudes with a total area estimated to be around 325 thousand km^2. The topography of the Somali Region is mainly lowland, however, there are some spots that are relatively high. The altitude ranges between 500 and 1, 600 meters above sea level (m.a.s.l). The average annual rainfall ranged from 300 mm to 500 mm and average monthly temperature ranges 16 to 20°C [12]. Data collected from Jigjiga for the period 1988 to 1998 indicate that areas with Jigjiga terrain and its surroundings received annual rainfall that ranges from a minimum of 340 mm to a maximum of 627 mm, which averaged to about 500 mm per annum. Fafen has a bi-modal rainfall pattern, usually occurring during the months of March to May and July to October. Fafen administrative zone is divided into three separate Food Economy Zones (FEZs), namely, sedentary agriculturalists, agro pastoralists and pastoralists. Agro-pastoralism is a dominant production system in Fafen Zone [13].

Study Animals: A total of 384 animals (198 goats and 186 sheep) were randomly selected from the area and examined for the presence of Ticks. Before clinical examination, the age, sex and body condition of each selected animals were recorded. Ages for both species were categorized into three categories, namely young, adult and old [14].

Study Design: Cross-sectional study design was employed from November 2014 to February 2015 to assess the prevalence of tick infestation and identify the common tick species in Fafen zone. Four peasant associations of Fafen and Bombas woreda (Golmodore, Aralaska, Sheikh-abdisalan and Bushuman) and two kebele of Jigjiga city including veterinary clinic were selected on the basis of purposive sampling based on the accessibility and their distribution.

Sample Collection and Identification: The selected small ruminants were examined from head to tail including legs for the presence of ticks on the body of the animals. The adult visible female and male ticks were collected from anove, head (eye, ear), scrotum, tail, leg and preserved in universal bottles containing 70% alcohol for further identification. The collected ticks from each bottle were placed onto petri-dishes and examined under stereomicroscope to identify to the species level with main identification features include color, size and shape of mouth parts, scutum, anal groove, festoon, punctuation and legs of the ticks according to Walker *et al.* [15] and Onkello-onen *et al*. [16].

Sample Size Determination: The desired sample size for the study was calculated using the 95% confidence interval and at 5% absolute precision. The sample size was determined by assuming the expected prevalence of 50% tick infestation based on previous study conducted in the country. Therefore, a sample size of 384 small ruminants (198 Goats and 186 Sheep) was examined in this study. The sample size was calculated using the Thrusfield formula [17].

Data Analysis: Data obtained was entered in Microsoft Excel word sheet and analyzed by using SPSS version 16.0 for windows software. Simple descriptive statistical analysis was used to analyze prevalence and distribution of tick species. Chi-square test was applied to compare the infestation rate with regard to body condition score, species, sex and age groups.

RESULTS

From the total examined animals, 306 (154 goats and 152 sheep) were infested by ticks. The prevalence of tick infestation in goats and sheep were 77.8% and 81.7%, respectively and the overall prevalence in both species in the study area was 79.7%. Overall prevalence of tick infestation in selected districts namely: Bombas, Fafen and Jigjiga was 86.1%, 77.45% and 73.8%, respectively (Table 1).

The difference in the prevalence of tick infestation between age and body condition of animals were statistically significant ($P<0.05$). The prevalence was higher in adult (88.5%) and old (83.1%) than young (36.8%) and higher in poor (89%) and medium body condition (87%) than good (74.9%) body condition. The prevalence found to be statistically insignificant within species and sex ($P>0.05$) (Table 2).

A total of 2441 number of ticks were collected from both goats and sheep. Upon identification, the ticks were classified into four genera and 7 species. Examined animals were considered to be positive for a given tick

Table 1: Overall prevalence of tick infestation in small ruminants in study area

	No. of examined		No. infested		Prevalence (%)		
Area	Goat	Sheep	Goat	Sheep	Goat	Sheep	Overall (%)
Bombas	85	77	70	63	90.5	81.8	86.1
Fafen	92	84	71	71	77.1	77.8	77.45
Jigjiga	21	25	13	18	61.9	85.7	73.8
Total	198	186	154	152	77.8	81.7	79.7

Table 2: Prevalence of tick infestation based on age, body condition score (BCS), species and sex

Variable		No. of examined	No. of infested (%)	X^2	*P value*
Age	Young	57	21(36.8)	77	0.000
	Adult	244	216(88.5)		
	Old	83	69(83.1)		
BCS	Poor	91	81(89.0)	9.888	0.007
	Medium	46	40 (87.0)		
	Good	274	185(74.9)		
Species	Goat	198	154(77.8)	0.921	0.337
	Sheep	186	152(81.7)		
Sex	Male	202	156(77.2)	1.593	0.207
	Female	182	150(82.4)		

BCS=body condition score

Table 3: Overall prevalence of total tick burden at genera level

Genus of ticks	Total No. of tick	% of total ticks
Rhipicephalus	1034	42.3
Hyalomma	882	36.1
Amblyomma	389	16
Rhipicephalus(Boophilus)	136	5.6

Table 4: Animal level prevalence of tick species in small ruminants

Tick species	Goat No. (%)	Sheep No. (%)	Overall No. (%)
R. evertsi evertsi	62(31.3)	72 (38.7)	134 (34.9)
H. truncatum	59(29.8)	55 (29.6)	114 (29.7)
A. variegatum	46(23.2)	36 (19.4)	82 (21.4)
R. pulchellus	38(19.2)	45 (24.2)	83 (21.6)
H. rufipes	31(15.7)	33 (17.7)	64 (16.7)
R. (B.) decoloratus	21(10.6)	22 (11.8)	43 (11.2)
A. gemma	2(1)	6 (3.2)	8 (2.1)

Table 5: Relative Prevalence of tick species in the study area

Tick species	Total No. of Ticks	%
R.evertsi evertsi	710	29.1
H. truncatum	643	26.3
A. variegatum	370	15.1
R. pulchellus	324	13.3
H. rufipes	239	9.8
R. (B.) decoloratus	136	5.6
A. gemma	19	0.8

infestation when at least one tick was collected from them. *Rhipicephalus* (42.3%) was the most abundant and widely distributed genus in the study area whereas *Rhipicephalus (Boophilus)Boophilus* (5.6%) was the least prevalent tick genus in the study area (Table 3).

R. evertsi evertsi was the most abundantly encountered species with high burden followed by *H. truncatum*, *A. variegatum, R. pulchellus, H. rufipes* and *R.* (*B.) decoloratus*. *A. gemma* was the minor species observed on both goats and sheep (Table 4).

DISCUSSION

The current study disclosed that tick infestation is still widespread and most significant external parasites of small ruminants in the study area. In this study a total of 384 small ruminants were examined and a total of 2441 visible adult ticks were collected from the body of 154 goats and 152 sheep. The distribution and abundance of tick species infesting small ruminants in Ethiopia are vary from area to area. In the present study 306 (79.7%) of small ruminants were found to be infested by one or more species of ticks. High prevalence of tick infestation in the study area was observed. This is may be due to agro-ecological condition of Fafen zone is favorable for the existence of ticks. This finding was in agreement with the previous investigation conducted by Abunna *et al.* [18] in Bedelle district, Oromia Region, Ethiopia, who recorded 76.50% overall prevalence of tick infestation in small ruminants. The prevalence found in the present study in goats (77.8%) and in sheep (81.7%) was almost similar with previous works conducted by Abunna *et al*. [19] in Miesso district, Western Harargie, who recorded the high prevalence of 87.5% (goats) and 89.9% (sheep). Similarly, Eyob and Matios [20] recorded a high prevalence of 97.58% (goats) and 69.86% (sheep) in Dhas district of Borena pastoral area, Southern Rangelands of Ethiopia and Abunna *et al.* [18] reported a higher prevalence of 66.12% (goats) and 80.30% (sheep) in Bedelle district, Oromia Region, Ethiopia.

However, the prevalence of tick infestation in the current study was higher than previous works conducted by Abebe *et al*. [21] in selected districts of Tigray region, Ethiopia with prevalence of 58.8% (goats) and 40% (sheep), Yacob *et al*. [22] in and around Wolaita Soddo, Southern Ethiopia with the prevalence of 18.6% (goats) and 31.8% (sheep) and Sertse and Wossene [23] in North East Ethiopia with prevalence of 3.4% (goats) and 22.2% (sheep). The difference in the prevalence might be due to the geographical difference, species difference of the study animals and season of the study period.

The prevalence of tick infestation between age groups was statistically significant ($P<0.05$). The difference between age groups was in agreement with the study conducted by Fentahun *et al*. [24] in and around Gondar town. This is because young animals were grazing around home than adult and old. Young animals have a minimum rate of exposure by tick since the number of ticks less around home as compare to animals graze in pasture [25]. The infestation of ticks was statistically significant ($P<0.05$) among body condition of animals. This is in agreement with the study conducted by Seid [26] in Mizzen Teferi. This is due to high infestation of tick result poor body condition due to consumption of high amount of blood and fluid by those ticks.

Ticks are the most important ectoparasites of livestock in tropical and sub-tropical areas and are responsible for severe economic losses both through the direct effects of blood sucking and indirectly as vectors of pathogens and toxins. In Africa, tick-borne protozoan diseases (e.g. theileriosis and babesiosis) and rickettsial diseases (e.g. anaplasmosis and heart water/cowdriosis and viral diseases (e.g. Nairobi sheep disease) are the main health problems of domestic ruminants. *Rhipicepalus evertsi evertsi* mainly transmits *Babesia ovis* to small ruminants [6]. Nairobi sheep disease (NSD)

is a tick-transmitted viral disease of small ruminants in East-Africa, transmitted by *Rhipicephalus* species and *Amblyomma variegatum. R. pulchellus* appears to be the principal tick vector as in northern Somalia and Ethiopia [27]. Certain species of these ticks have a toxin in their saliva that causes the skin disease known as sweating sickness [15]. *B. decolaratus* can transmit *Babesia begmina* and *Anaplasma marginale* to ruminants and severe tick infestation can lead to tick worry and anemia [28].

CONCLUSION

In the present study seven species of ixodid ticks grouped under four genera were identified. The tick species identified were *Rhipicephalus evertsi evertsi*, *Hyalomma truncatum*, *Rhipicephalus pulchellus*, *Amblyomma variegatum*, *Hyalomma rufipes*, *Boophilus decoloratus* and *Amblyomma gemma*. The most important and abundant tick species identified in study area were *Rhipicephalus evertsi evertsi* and *Hyalomma truncatum* in order of predominance. The prevalence of tick infestation in this study was statistically significant within age and body condition of animals.

Generally ticks are highly prevalent in this study area this is due to inadequate veterinary services, favorable climatic conditions and poor awareness of owners on the impacts of tick infestations and lack of effective and planed control strategy in the study area. Therefore, attention should be given to the control and prevention of tick infestation and awareness creation for the local farmers about the control of tick is essential.

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