

Ixodid Ticks Infesting Domestic Small Ruminants in and Around Dire Dawa City

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Abstract: Ticks are directly or indirectly involved in causing substantial financial losses to livestock industry of Ethiopia. A cross-sectional study was conducted from October, 2022 to September, 2023 to determine the prevalence of tick infestation in small ruminants in five kebeles of Dire Dawa regional State, Eastern Ethiopia. A total of 384 small ruminants (130 Sheep and 184 goats) were selected and a total of 2,304 visible adult ticks were collected from the body of both goats and sheep. Ten species of ticks grouped under five genera were identified. From the total examined animals, 315 (82.02%) were found to harbor different tick genera. The frequency of tick infestation in domestic small ruminants for different study site were 77(20.1%), 78(20.3%), 74(20.1%), 78(20.3%) and 76(19.8%) in Ija anani, Ganda kore, M. jabdu, Sabian and Ganda rige, respectively. The species identified included *Rhipicephalus pulchellus* (47.4%), *Rhipicephalus evertsi* (28.9%), *Rhipicephalus* (formerly *Boophilus*) *decoloratus* (23.2%), *Amblyomma coherence* (24.5%), *Amblyomma variegatum* (36.7%), *Amblyomma gemma* (24%), *Hyalomma truncatum* (37%), *Hyalomma marginatum* (25.3%), *Hyalomma anatolicum* (20.3%) and *Haemaphysalis leachi* (16.9%). The prevalence of tick infestation between age and body condition of animals were statistically significant ($P < 0.05$). 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: Dire Dawa • Tick Infestation • Small Ruminant

INTRODUCTION

Ethiopia has the largest livestock population in Africa, with 65 million cattle, 40 million sheep, 51 million goats, 8 million camels and 49 million chickens [1]. Among livestock, small ruminants play a significant role in socio-economic life of the people of Ethiopia. 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 [2]. Ticks are one of the most serious ectoparasites in Ethiopia. Ticks are most numerous, particularly in tropical and sub-tropical regions and their impact on animal health and production is greatest in these region [3].

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 downgrading of hides and skins in Ethiopia [4, 5]. 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 [6]. They cause the greatest economic losses in livestock production. Their effects are various including reduced growth, milk and meat production, damaged hides and skins, transmission of tick-borne diseases of various types and predispose animals to secondary attacks from other parasites [7, 8].

Ticks are small, wingless ectoparasitic arachnid arthropods that are cosmopolitan and prevalent in warmer climates [5]. Ticks are obligate, blood feeding ectoparasites of vertebrates, particularly mammals and birds [9].

Ticks are within a member called the phylum (Arthropoda), class (Arachnida), sub class (Acari) and Order (Parasitiformes) [10]. Within the Parasitiformes, ticks belong to the suborder Ixodida, which contains a single super family, the Ixodoidea, which is divided into three major families, Argasidae (soft ticks) and Ixodidae (hard ticks) and the rare family Nuttalliellidae, with a single African species [11].

Tick morphology are main identification of tick species and it consists of two primary regions, the mouthparts (capitulum) and the body (idiosoma). The mouthparts on hard ticks protrude in front of the body and the body of soft ticks extends forward above the mouth parts so they are only visible from beneath [12]. The body of ticks includes the eyes, legs and respiratory, digestive and reproductive structures. The mouthparts (capitulum) have three specialized structures called palps, chelicerae and a hypostome that are attached to a base called the basis capituli. The body (idiosoma) of ticks is typically not hardened to a great extent [13]. In hard ticks, most of the exterior cuticle is soft and has many internal folds that look like grooves on the surface of the body. The uniform, rectangular folds located on the rounded posterior end of hard ticks are called festoons. Unfolding and stretching of the soft cuticle along these grooves allows immature and adult female hard ticks to take enormous blood meals and swell to weigh 50 to 100 times their original weight [6].

Some ticks live in open environments and crawl onto vegetation to wait for their hosts to pass by. This is a type of ambush and the behavior of waiting on vegetation of is called questing. Thus in genera such as *Rhipicephalus*, *Haemaphysalis* and *Ixodes* the larvae, nymphs and adults will quest on vegetation. The tick grabs onto the host using their front legs and crawl over the skin to find a suitable place to attach and feed. Adult tick of genera *Amblyomma* and *Hyalomma* are active hunters, they run across the ground after nearby hosts [2]. Ticks that are considered most important to domestic animals' health in Africa comprise about 7 genera and sixteen species [3]. In Ethiopia, there are 47 species of ticks found on livestock, most of them have importance as vector and disease-causing agents, have damaging effect on skin and hide production [12].

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 [13]. Numerous studies have been conducted on tick and tick-borne diseases of ruminants in various parts of Ethiopia and several species of ticks belonging to genus *Amblyomma*, *Boophilus*, *Rhipicephalus*, *Hyalomma* and *Haemaphysalis* have been reported. Among these tick genera, the main ticks found in Ethiopia are *Amblyomma* (40%), *Boophilus* (21%), *Haemaphysalis* (0.5%), *Hyalomma* (1.5%) and *Rhipicephalus* (37%) [9].

Many studies on tick distribution, prevalence, species identification, effect on domestic animals and methods of prevention were done as compared to other important skin diseases of animals in Ethiopia. Both hard ticks (*Ixodidae*) and soft ticks (*Argasidae*) are known to affect small ruminants. Among these, *Amblyomma* species (*A. variegatum*, *A. coherence*, *A. gemma*,) are known tick species identified. *B. decoloratus* is also encountered in small ruminants [14]. *Rhipicephalus* species [15, 16], *Hyalomma* species [17]: and *Haemaphysalis* species [5, 15] were identified [18] also showed that these tick genera are frequently encountered in Ethiopia. Ticks are common in all agro-ecological zones of Ethiopia [2].

Even though different studies were done on camel ticks, cattle ticks and other domestic animals in the Eastern part of the country [19] little attention was given to ectoparasites of small ruminants in the study area. Moreover, there was not specific study conducted on status of tick infestation on small ruminant in Dire Dawa. Therefore, this study aimed to identify the tick species on small ruminants in the study area.

MATERIALS AND METHODS

Study Area Description: The study was conducted in Dire Dawa Administrative Council, Eastern Ethiopia. It is situated about 510 km East of Addis Ababa. The rainfall pattern of the area is characterized by small rainy season from February to May and relatively long rainy season from July to September with the mean annual rainfall ranging from 550 to 850 mm. The area has a monthly mean minimum and maximum temperature of 14.5°C to 34.6°C. The entire territory of the Dire Dawa Administrative Council rests at an elevation ranging between 950 m in the North East to 2260 m in the South West. Due to the narrow altitudinal ranges using the 1500m contour as a line of separation, two agro ecological zones, the low land (below 1500m) and midland (above 1500m) have been recognized by DDAC, Agricultural Bureau. (1998). The total livestock population in Dire Dawa administrative council is estimated to be about 313, 000, including 100,

000 goats, 86, 000 sheep, 65, 000 cattle, 22, 000 equines, 20, 000 camels and 20, 000 poultry. The administrative council is composed of 9 urban and 38 rural kebeles administrations. Large proportion of livestock kept in the arid part of the region mainly by pastoral community [20].

Study Population and Sampling Methods: The study was conducted on small ruminants (sheep and goats) of five kebeles found in and around Dire Dawa Administrative council namely Ganda Rige, Ija Aannani, Ganda Kore, Malka Jabduu and Sabean. Purposive sampling depending on their animal population and nearness to the town will be selected villages from the administrative council. Systematic random sampling method will be employed at grazing areas and watering point to examine each sheep and goats for the presence ectoparasite. Data of animal species, sex, age, body condition score and predilection sites was recorded for each animal selected before examination. Small ruminants all age group and sex were included to study. Proportional probabilities to the number of animals for each study area were used to determine the number of animals to be considered from each kebele.

Study Design and Sample Size Determination: A cross sectional study design was used to determine the prevalence of tick infestation and to identify types of tick species infesting sheep and goats in the study areas. The number of animals to be sampled in the study was estimated by the formula described by Thrusfield, [21].

$$(n = 1.96 * 2(Pexp(1 - Pexp/d2)).$$

Therefore, the sample size was determined by assuming the expected prevalence of 50% tick infestation and setting 95% confidence interval at 5% absolute precision. Accordingly, 384 small ruminants was considered for this study.

Clinical and Laboratory Investigation: All visible attached adult ticks were collected carefully and gently removed exerting a horizontal pull to the body surface by rotating the tick not to damage the host by the tick mouth parts and then the collected ticks were preserved in properly labeled plastic container containing 70% ethanol. The bottle was labeled with date, place, sex, age and site of the body and then transported to Dire Dawa Veterinary Regional Laboratory for parasitological analysis. The collected ticks from each container was

placed onto Petridishes and examined under stereomicroscope to identify the species using tick identification keys described by Walker *et al.* [3]. Briefly, the main identification features of the ticks are color, size and shape of mouth parts, Scutum, anal groove, festoon, punctuation and legs [3].

Data Analysis: The raw data obtained from selected area and laboratory examination was inserted into Microsoft excel spread sheet to create a data base. The collected data was analyzed using SPSS version 20.0 software program. Descriptive statistics was used to summarize tick species identified. Chi-square test was used to evaluate association between hypothesized risk factors like age, sex, body condition score and species and tick infestation status of the animal. P-value of < 0.05 was considered as significant.

RESULTS

In the present study a total of 384 domestic small ruminants were examined for tick infestation. Out of these, 315 (82.02%) were infested with one or more genera or species of tick. The frequency of infestations for different species of small ruminants with ticks was recorded. The frequency of tick infestation in domestic small ruminants for different study site were analyzed and recorded as 75(83.1%), 78(82.05%), 76(81.6%), 78(80.7%) and 77(83.1%) in Ija anani, Ganda rige Ganda kore, Sabian and M. jabdu, respectively (Table 1).

A total of 2, 304 number of ticks were collected from both (n=184) goats and (n=130) sheep. Upon identification, the ticks were classified into five genera and 10 species based on their morphological characteristics and area of distribution using dichotomous key or tick identification guideline (Table 2)

All collected ticks were identified and categorized in to five genera namely *Ambylomma*, *Rhipicephalus*, *Hyalomma*, *Bophilus* and *Haemaphysalis* (Fig. 1). Under the genus *Rhipicephalus* two species were identified; namely; *Rh. Pulchellus* (38.52%) and *Rh. Evertsi* (22.38%). This genus contained higher percent of the total tick collected, where *Rh. pulchellus* is the most abundant species and accounts 38.52% of the total tick collected. The genus *Hyaloma* is the most abundant that contains higher percent of total tick collected next to genus *Rhipicephalus* and *Hy. truncatum* is the most abundant species that accounts (30.45%) of the total tick collected. The genus *Ambylomma* account higher

Table 1: Prevalence of tick infestation in different study sites

Study site	No of animals examined	No of positive animal	Prevalence (%)
Ija anani	75	61	81.3
Ganda rige	78	64	82.05
Ganda kore	76	62	81.6
Sabian	78	63	80.7
<i>M. jabdu</i>	77	64	83.1
Total	384	315	82.02

Table 2: Species composition of ticks found in small ruminants and their attachment sites

Species	Number of Spp identified	Proportion%	Attachment sites of the body parties
<i>Rh. pulchellus</i>	364	47.4	Head, ear, tail (base of tail)
<i>Rh. evertsi</i>	222	28.9	Ear, tail (base of tail), head
<i>Rh. decoloratus</i>	178	23.2	Scrotum, udder, tail
<i>A. cohorence</i>	188	24.5	scrotum, udder, leg
<i>A. variegatum</i>	282	36.7	Udder, scrotum, tail
<i>A. gemma</i>	184	24.0	Ear, scrotum, tail, udder
<i>Hy. truncatum</i>	284	37.0	Leg, tail, scrotum
<i>Hy. marginatum</i>	194	25.3	Leg, scrotum, tail
<i>Hy. anaticum</i>	156	20.3	Scrotum, leg, tail
<i>Ha. leachi</i>	130	16.9	Head

Table 3: Distribution of tick species in different species of small ruminant

Tick Species	Frequency (Proportion) on	
	Sheep	Goat
<i>Rh. pulchelus</i>	116(15.10%)	180(23.43%)
<i>Rh. evertsi</i>	84(10.93%)	88(11.45%)
<i>Rh. decoloratus</i>	56(7.28%)	96(12.50%)
<i>A. variegatum</i>	82(10.67%)	146(19.00%)
<i>A. gemma</i>	58(7.54%)	94(12.23%)
<i>A. coherence</i>	64(8.33%)	94(12.23%)
<i>Hy. marginatum</i>	66(8.59%)	102(13.27%)
<i>Hy. anaticum</i>	58(7.54%)	66(8.59%)
<i>Hy. truncatum</i>	90(11.71%)	144(18.74%)
<i>Ha. leachi</i>	40(5.20%)	62(8.07%)

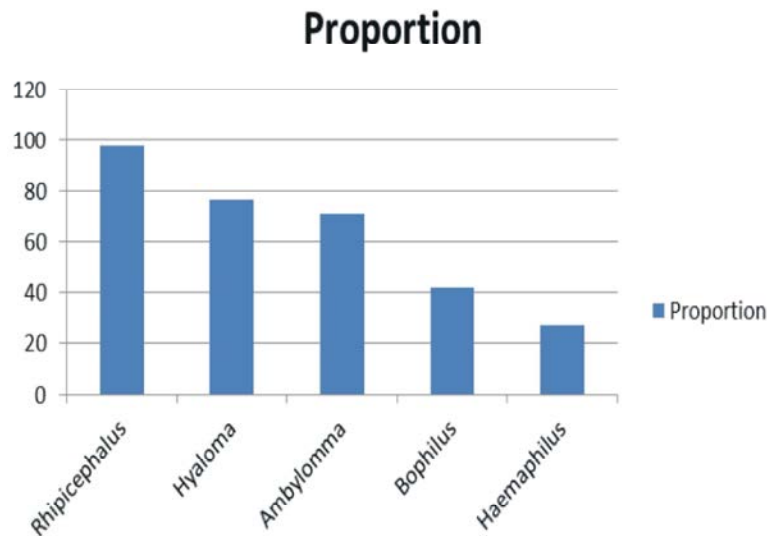


Fig. 1: Genera level of tick classification and their proportion

percent of the total adult ticks next to genus *Hyalomma* and *A. variegatum* is the most abundant species of this genus and accounts 29.67% of tick collected. Genera *Rhipicephalus* and *Haemaphysalis* was also identified. Ear, scrotum and under tail were the most common body parts from which ticks collected.

Further species level identification of tick species on different animal species indicate the result indicated in Table 3. In all cases the proportion of tick infestation in goat was higher than that of sheep. *Rh. Pulchellus*, *A. Variegatum* and *Hy. Truncatum* were the most dominant species identified in goat species.

DISCUSSION

The most important external parasite of small ruminants in the study area, according to the current study, is tick infection, which is still common. 315 (82.03%) of the 384 small ruminants that were evaluated in this study had infestations. 2, 304 adult ticks that could be seen were extracted from the bodies of 130 sheep and 184 goats.

The distribution and abundance of tick species that infesting small ruminants in Ethiopia are vary from area to area. In the present study, the small ruminants were found to be infested by one or more species of ticks. The present study revealed that sheep and goats in the study area were highly infested by different genera of ticks namely, *Amblyomma*, *Rhipicephalus*, *Haemaphysalis* and *Hyalomma*.

The higher prevalence (82.02%) of tick infestation on small ruminants in the current study was not in agreement with the previous investigation conducted by Abebe *et al.* [22] in selected districts of Tigray region, with prevalence of 58.8% (goats) and 40% (sheep) and with the reports done by Jafar *et al.* [23] in Dire Dawa, Eastern Ethiopia, who recorded a prevalence of the tick infestation on goat (73.9 %) and on sheep (70.7 %). The current result was relatively consistence with Megersa *et al.*[24] in Mieso district, Western Hararghe, who recorded a prevalence of 87.5 % (goats) and 89.9 % (sheep), but lesser than Eyob *et al.* [25] who recorded a higher prevalence of tick infestation on 97.58% (goats) and on 69.86% (sheep) in Dhas district of Borana pastoral area, Southern Range lands of Ethiopia. The prevalence of tick infestation of the present was higher than the previous recorded by Yacob *et al.*[26] in North East Ethiopia with prevalence of 3.4% (goats) and 22.2% (sheep). The difference in the infestation of ticks might be due to the grazing system of species, the exposure to tick dominant area, high movement of species and other

factors such as due to the geographical difference and season of the study period, frequent exposure to the same communal grazing land that favored the frequent contact and management of animals.

The prevalence of tick infestation between age groups was statistically significant ($P < 0.05$). The frequency of tick infestation on young was 135 (35.14%) and adult 181 (47.11%). The difference between age groups was in agreement with the study conducted by Mehari [27] around Awassa. The probable reason for this might be due to the fact that young animals were grazing around home than adult and old. This in turn contribute to a minimum rate of exposure by tick since the number of ticks less around home as compared to animal's graze in pasture mostly adult and old animals [28]. The different frequency of tick infestation on small ruminant recorded based on body condition score (BCS) at the present study were 162 (42.17%) on poor, 117 (30.45%) on medium and 35 (9.11%) on good. This is in agreement with the study conducted by Seid [29] 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. The frequency of tick infestation was higher in females 178 (46.33%) than in males 138 (35.92%). The present study was comparable with the previous recorded by Jafar *et al.*[23] who recorded the prevalence of tick infestation was higher in females (79%) than in males (64.8%). Although the exact cause of higher frequency of tick infestation in female animals cannot be explained but it can be assumed that some hormonal influences may be associated with this phenomenon. In fact, higher level of prolactin and progesterone hormones could make the females more susceptible to any infection [30]. Moreover, stress of production, pregnancy and lactation could have made the female animals more susceptible to infection.

During the conduction of the present research study period the four genera of ticks such as *Amblyomma*, *Rhipicephalus*, *Hyalomma* and *Haemaphysalis* were identified. This study result was comparable with the previous study conducted by Abebe *et al.* [22]. The principal tick species infesting small ruminants in the study area comprise *Amblyomma cohorence* *Amblyomma gemma*, *Amblyomma variegatum*, *Rhipicephalus (Boophilus) decoloratus*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus pulchellus* and *Hyalomma truncatum*, *Hyalomma marginatum* and *Hyalomma anatolicum* *Haemaphysalis leachi*. *Rhipicephalus pulchellus* and *Hyalomma anatolicum* were the most abundant tick species in the area. The present study was similar with the previous study conducted by Abebe *et al.* [22],

Abunna *et al.* [31] where *Rhipicephalus pulchellus* was the most abundant tick species in small ruminants at Mieso district, west Hararghe area and Dire Dawa Eastern Ethiopia, also reported a similar finding. It is widely distributed and common on domestic livestock in Ethiopia [32]. This further indicated that the finding of this tick in the area is in line with its wide spread occurrence in most parts of the country. The second most abundant tick species was the *Hy. truncatum* and the third species was *A. cohorence*.

CONCLUSION AND RECOMMENDATION

Among livestock, small ruminants play a significant role in socio- economic life of the people of Ethiopia. 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. Ticks are obligate blood feeding ectoparasites of vertebrates and induce huge production loss in livestock industry and creating serious public health problems in the world. The main tick genera found during this study were *Amblyomma*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. Ten species of ixodid ticks grouped under four genera were identified. The tick species identified were *Rh. evertsi*, *Hy. truncatum*, *Rh. pulchellus*, *A. variegatum*, *Hy. rufipes*, *A. gemma*, *Rhipicephalus (Boophilus) decoloratus*, *Hy. marginatum*, *Hy. anaticum* and *Ha. leachi*. The most important and abundant tick species identified in study area were *Rh. pulchellus* and *Hy. anaticum* 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 planned control strategy in the study area.

Based on the above conclusion the following recommendations were forwarded:

- 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.
- There should be adequate veterinary service in the study area

- Further research should be conducted to the molecular level to design control strategy.

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