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Prevalence of Ixodid Ticks on Cattle in Northwest Ethiopia

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Abstract: A cross-sectional study was conducted in Dembia district, North Gondar zone, from November, 2013 to April, 2014 to investigate the distribution and abundance of tick parasites in cattle and the species composition. Adult ticks were collected from 384 local and cross-breed cattle. Out of the total of 384 cattle examined, 312 (81.25%) were found to be infested by one or more tick parasites. A total of 1451 adult ticks were collected from the animal body parts and were identified to genera and species level. Eight tick species of four genera were identified. From the total ticks collected *Amblyomma*, *Hyalomma* and *Rhipicephalus* account 20.74, 20.34 and 58.92 % respectively. The relative prevalence of each species was *Rhipicephalus* (*Boophilus*) *decolaratus* (40.86%), *Rhipicephalus evertsi evertsi* (11.51%), *Amblyomma varigatum* (13.64%), *A. cohaerense* (5.21%), *A. lepidum* (1.92%), *R. simus*(6.54%), *Hyalomma marginatum* (12.96%) and *Hyalomma truncatum (*7.36%). The risk factors breed, sex and age of cattle did not show any statistical significant association with the infestation rate but there was statistical significant association of infestation rate with the body conditions of animals. The prevalence of tick infestation was found highest in poor body condition (98%) while in medium body condition it was (76.11%) and in good body condition it was found 74.04%. It has also been evident that the favorable predilection sites of *Amblyomma* species were ventral body parts and perineum region. *Rhipicephalus decolaratus* preferred dewlap, udder/scrotum, belly, leg, head and perineum. *Rhipicephalus* species had a strong affinity for perineum, dewlap, udder/scrotum, tail tips and ears. For Hyalomma species, the perineum region, udder/scrotum and under tail were its hiding sites. It is concluded that the prevalent tick species could also be responsible for transmission of tick born diseases in addition to their physical damage to the skin. Therefore, further studies should be carried out on tick burden and tick born diseases thereby mitigating for prevention and control strategies.

Key words: Dembia District · Prevalence

INTRODUCTION

Ethiopia has the largest number of livestock in Africa, approximately 53.99 million cattle, 25.5 million sheep and 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, 50.38 million poultry and 5.21 million bee hives [1]. Among livestock, Cattle play a significant role in the socio-economic aspects of the life of the people in Ethiopia. In addition to the products like meat and milk cattle provide draught power for cultivation of the agricultural lands of many peasants. Skins and hides are also important components of the livestock sector in generating foreign export earnings [2]. Even though they are important components of the Ethiopian farming system, their contribution to food production, rural income and export earnings are far below the expected potential. This is because cattle production in Ethiopia is constrained by the compound effects of animal diseases, poor feeding and poor managements [3].

Now a day parasitism represents a major obstacle to development and utilization of animal resource. In Ethiopia, ectoparasites in ruminant causes serious economic loss to small holder farmers, the tanning

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industry and the country as a whole through mortality of animals, decreased production, down grading and rejection of skin and hide [4]. As a result of their activity ectoparasites may have a variety of direct and indirect effects on their hosts. Ectoparasites commonly tick, mite and lice affect the condition of host species by the inflammation and the infection they inflict on the skin [5] and by their effect on the physiology of the animals as well as through transmission of different diseases [6-7]. Infestations by ectoparasites significantly affect the quality of hide thereby affecting the economy of Ethiopian farmer's as well as international market [8].

Ticks are the most important ecto-parasites of livestock in tropical and sub-tropical areas and are responsible for severe economic losses in livestock. The major losses, however, caused by ticks are due to their ability to transmit protozoan, rickettsial and viral diseases of livestock, which are of great economic importance world-wide. Tick-borne protozoan diseases (Theileriosis and Babesiosis) and rickettsial diseases (Anaplasmosis and Ehrlishiosis) and tick-associated dermatophilosis are major health and management problems of livestock in many developing countries. The most economically important ixodid ticks of livestock in tropical regions belong to the genera of *Hyalomma*, *Rhipicephalus* and *Amblyomma* [9].

A complex of problems related to ticks and tick-borne diseases of cattle created a demand for methods to control ticks and reduce losses of cattle production and productivity [10]. Control of tick infestations and the transmission of tick-borne diseases remain a challenge for the cattle industry in tropical and subtropical areas of the world. Tick control is a priority for many countries in tropical and subtropical regions [11].

In Ethiopia, there are 47 species of ticks found on livestock and most of them have importance as vectors for diseases and also have damaging effect on skin and hide production [12]. Ticks, besides being important vectors for diseases like theilerosis, anaplasmosis, babesiosis and ehrlishiosis in domestic animals; they also cause nonspecific symptoms like anemia, dermatosis, toxicosis and paralysis [13].

Although 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; it has not been yet enough to have the country wide distribution figures and their burden. Thus, the current study was designed in Dembia district where previous studies didn't touch with the following objectives. To assess the prevalence of major ixodid tick parasites on cattle, to identify the prevalent ticks to the genera and species level and to recommend suggestions (prevention and control options) based on the result of the study.

MATERIALS AND METHODS

Study Area: The study was conducted from November, 2013 to April, 2014 in Dembia district at Kolladiba Veterinary Clinic. Dembia is found in north Gondar administrative zone, Amhara national regional state and located 35 km south west of Gondar city. Geographically the area lies between 12.5° latitude and 37.1° longitude with an altitude of approximately 1700 to 2700 m.a.s.l; and it bounded by Lay Armachiho in North, Lake Tana in South, Gondar Zuria district in East and Chilga district in the west direction and Takusa district in Southwest direction. The average annual rain fall varying from 700-1160 mm and mean annual temperature of Dembia varies from 18 to 28 °C. It has a total area of 146, 968 hectares; out of this 19,004 hectare is grazing land. Topographically, about 85% of the land is featured by plain plateaus and covered by various bush formation, low woods mainly every green lands and some semi-humid and humid highland vegetation, with major agricultural products like teff, wheat, sorghum, maize and pulse crops; 8% mountain, 4.8% valley and 2.2% is water body covered land. This district has 45 kebeles, 40 of which are rural and the remaining 5 are urban with an estimated human population of 291,000 [14].

According to the Dembia Woreda Rural Development and Agricultural Planning Office (DWRDAPO, 2014) the district has a livestock populations of cattle, 243842 (local) and 3435 (cross), sheep (58601), goat (18,659), mule (269), horse (58), donkey (20205), poultry local (147720) and cross (975) and bee colonies are kept in three categories of bee hives: traditional (20336), transitional (120) and modern (862) bee hives.

Study Design: A cross-sectional study was carried out in cattle which were managed most extensively and some semi-intensively in the study area. In this study a simple random sampling techniques was employed from a population cattle which were brought to kolladiba veterinary clinic. Cattle which were included in the sample were examined carefully for the presence or absence of ticks on their body parts. Then the collected ticks were carefully examined to group them in to their genera and species levels using the guide indicated in Walker *et al*. [15].

Study Population: The study subjects were cattle of different breed, age and sexes brought to Dembia district veterinary clinic. The origins of these animals were from different kebeles in the district. A total of 384 animals (local and cross breed) were randomly selected and examined. The age, sex, breeds and body condition scores of each animal were also recorded.

Sample Size Determination: Taking an estimated prevalence of 50%, the minimum sample size at 95% confidence interval and at 5% precision or accuracy level the sample size was calculated to be 384 using the formula given by Thursfield [16].

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

Where: n = sample size;

Pexp = minimum expected prevalence = 50%
1.96 = the value of z at 95% confidence interval
d = desired accuracy level at 95% interval.

Samples and Sampling Methods: Ticks were collected manually from their attachment site in the host animal which was brought to kolladiba veterinary clinic by using sampling bottle containing 70% alcohol for prolonged storage. Then samples were transported to Gondar university veterinary parasitology laboratory for the identification of the major ixodid ticks genera and species level as well. Cattle were categorized into three age groups according Aiello and Mays [17]. These are <1 year, 1-3years and >3years), breed (local and cross) and body condition score (poor, medium and good).

Tick Collection and Identification: After the selected animals were restrained properly, all visible adult ticks were collected from their half body part manually by using forceps. Ticks with their intact mouthpart were collected carefully for proper species identification and they were preserved in 70% alcohol as outlined in Jana and Rajput *et al*. [18]. Then it was labeled with the date of collection, age and sex of the hosts. They were identified by using a stereomicroscope according to standard identification keys given by [15]. During processing, the tick sample in each sampling bottle were transferred to a petridish, unwanted foreign materials such as hair, dry skin and other dirt were removed. The ticks then spread on filter paper to absorb excess preservative fluid. Ticks with dirty scutum were rubbed on filter paper to make them clean and easy for identification [15]. The count of ticks from half body zone of each animal was doubled to give the total number of ticks per animal, assuming equal number of infesting ticks on both sides of an animal.

Data Management and Analysis: The information/data obtained from history, clinical examination, tick identification and observations were entered to Microsoft worksheet excels. Then descriptive statistics was used to analyze the data using statistical package for social sciences (SPSS) software version 17. Chi-Square test (x^2) with computed p-value of less than 0.05.was used to determine the statistical significance association of tick infestation rate with sex, breeds, age groups as well as body condition scores.

RESULTS

Prevalence: In this study a total of 384 animals were examined. Among these 348 (90.625%) were local and 36 (9.375%) were cross breeds. Then the overall prevalence of ticks from the total population was found 81.25% (312/384). The study was also investigated the types of the ticks genera and their spatial distribution on the body of the animal. The prevalence of ticks in less than one year, one to three years and greater than three years was found 72.72, 80 and 81.91%, respectively. Based on their sex variation, it was 80.84 % in males and 81.76% in female animals. Variation in breed also matters its prevalence rate in that local breeds were affected less as compared with cross breeds; 80.46% and 88.9%, respectively. Poor body conditioned animals were found severely affected with ticks than medium and good body condition animals as seen in (Table 1).

Tick Identification: Four general of ticks namely *Amblyomma*, *Hyalomma* and *Rhipicephalus* were identified in the study period. From the total ticks collected, *Amblyomma*, *Hyalomma* and *Rhipicephalus* account 20.74, 20.33 and 58.92 % respectively (Figure 1).

Species Identified: The most important species encountered from the genus was *Rhipicephalus decoloratus* 40.86% (593/1451). From the genera *Amblyomma* tick three species were identified namely; *A. varigatum*13.64% (198/1451), *A. cohaerens* 5.21% (75/1451) and *A. lepidum* 1.92% (28/1451). The genus Hyalomma was represented by 12.96% of *Hyalomma marginatum* and 7.36% *Hyalomma truncatum*. *Rhipicephalus* was also identified in *R. evertsi-evertsi* 11.51% (167/1451) and *R. simus* 6.54% (95/1451) (Fig. 2).

Table 1: Prevalence of ticks with relation to different risk factors in both cross and indigenous cattle in Dembia District (from December, 2013-May, 2014)

Risk Factors	Animals Examined	Animals Positive	Prevalence (%)	P-value	x^2
Age					
Less than one year	11	8	72.72		
One to three years	80	64	80	0.252	7.818
Greater than three years	293	240	81.91		
Sex					
Male	214	173	80.84	0.335	3.394
Female	170	139	81.76		
Body condition score					
Poor	100	98	98		
Medium	180	137	76.11	0.000	49.72
Good	104	77	74.04		
Breed					
Local	348	280	80.46	0.182	4.865
Cross	36	32	88.9		

Table 2: Proportion and host body site distribution of tick species

Species of ticks	Number of ticks	Predilection sites
Amblyomma variegatum	198	Scrotum, brisket, belly, dewlap, vulva, perineum
Amblyomma cohaerens	75	Udder, vulva, dewlap, perineum, belly, brisket
Amblyomma lepidum	28	Udder, vulva, dewlap, perineum
Rhipicephalus decoloratus	593	Dewlap, ears, scrotum, brisket, udder, flank, legs
Hyalomma marginatum	188	Under, tail, anus
Hyalomma truncatum	107	Udder, under tail, scrotum, anus
Rhipicephalus evertsi-evertsi	167	Udder, tail, vulva, anus
Rhipicephalus simus	95	Ear, tail tuft, udder, dewlap, brisket

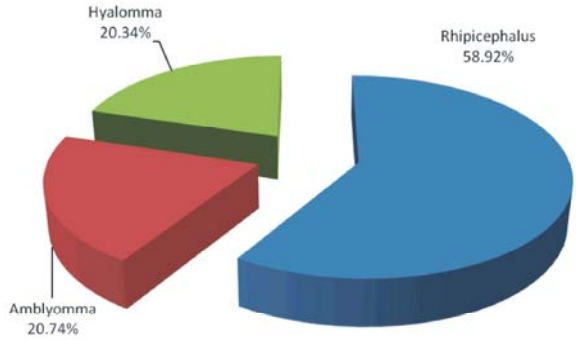

Fig. 1: The tick genera identified and their proportion

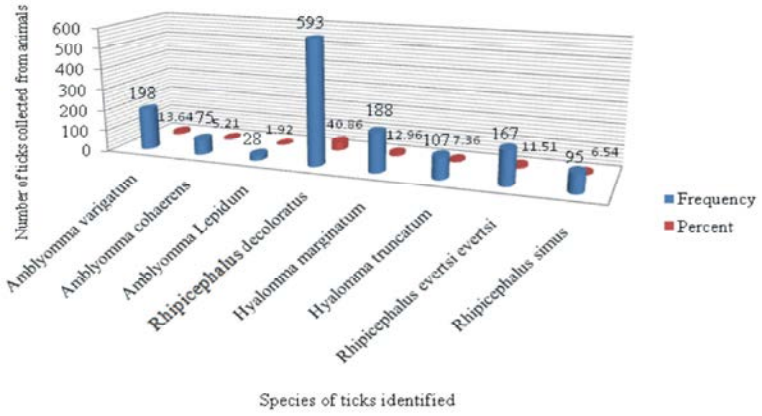

Fig. 2: Species of ticks identified and the frequency of occurrence in Dembia district

Ticks Body Part Distribution: Ticks were found widely distributed in different parts of the hosts' body such as ear, neck, tail, mammary gland, brisket, belly, udder/scrotum and perinial region. Of these sites udder/scrotum, dewlap, anal area and tail regions were most infested parts of the animal's body and face and neck was the least affected (Table 2).

DISCUSSION

The total tick infestation prevalence was found 81.25%. This result was in agreement with the findings of Regassa [19] who reported a prevalence of 82% in Borena province of southern Oromia. However, this finding is greater than the reports of Kassa and Yalew [20] with a prevalence of 33.21% in Haramaya district and Tesfaheywet and Simeon [21] a prevalence of 16.0% in Benchi Maji Zone of the Southern Nations and nationalities of Ethiopia. In contrast to this, Nigatu and Teshome [22] were reported a higher prevalence of ticks (89.4%) from Western Amhara Region.

Amblyomma, *Hyalomma* and *Rhipicephalus* were the three important genera of ticks encountered with a total prevalence of 20.74, 20.34 and 58.92% respectively. The genus *Rhipicephalus* tick was greater in prevalence in this study than Kassa and Yalew's report in 2012 from Haramaya district (31.4%), Sileshe's [23] a country report (21%) and Tamiru and Abebaw's [2] in Asella (15.4%). But it was reported in a greater prevalence rate (45%) than the current study (40.86%) in Bossena and Abdu's [24] study in and around Assosa.

Amblyomma tick infestation was indicated higher in studies of Kassa and Yalew [20], Tamiru and Abebaw [2], Bossena and Abdu [24] and Sileshe [23] with a prevalence of 47.16, 60.1, 45 and 40% respectively. The most important *Amblyomma* tick species encountered in this study were *A. variegatum, A. cohaerens* and *A. lepidum* with prevalence rates of 13.64, 5.21 and 1.92% respectively. Bossena and Abdu [24] from in and around Assosa reported almost similar results for the occurrence of *A. variegatum* (15%). But Nigatu and Teshome [22] from western Amhara, Tamiru and Abebaw [2] from Asella, Kassa and Yalew [20] from Haramaya district and Nibret *et al.* [25] from Chilga District found 49.2, 48.2, 38.87 and 51.19%, respectively. However, lower prevalence of *A. variegatum* (4.7%) was recorded in the research findings of Tesfaheywet and Simeon [21] from Benchi Maji Zone.

The genus *Hayalomma* tick (20.34%) prevalence in this study was much greater than Sileshe's report (1.5%) in 1996 which is off course a country report. *Hyalomma* species prevalence reported by Regassa [19]; *H. truncatum* and *H. marginatum* (0.56 and 0.08%) and by Tamiru and Abebaw [2]; *H marginatum* (2.5%) were also much less than current findings of this study; *H. marginatum* of 12.96% and *H. truncatum* 7.36%.

In this study, *Rhipicephalus* tick was found represented by two species namely *R. evertsi evertsi* (11.51%) and *R. simus* (6.54%). The findings of Tamiru and Abebaw [2], Kassa and Yalew [20], Bossena and Abdu [24] and Nibret *et al.* [25] were 22, 14.66, 15.6 and 18.22% for *R. evertsi evertsi* respectively. These were greater in picture than the current study. However, studies by Nigatu and Teshome [22] indicated lesser prevalence of 6.6% from western Amhara Region.

Certain risk factors were also found involved in the variations of the prevalence of ticks in the study area. These were sex, age, breed and body condition scores.

Male animals were found slightly less affected than female counter parts (in male 80.84% and in female it was 81.76%) with no statistical significance (P- value>0.05 and X^2 = 3.394). This result is concurred with the results of Tesfahewet and Simeon [21] and Kassa and Yalew [20] where the p-values were > 0.05. 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 prevalence of ticks was 98, 76.11 and 74.04% in poor, medium and good body condition scores. It appears with statistical significance association where the p value is less than 0.05 and chi-square 49.72. Similar finding was indicated in Bossena and Abdu [24]. 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.

Age also matters in the prevalence of ticks in cattle in the study area. In those less than one year it was 72.72% while in one year to three year and greater than three years were 80 and 81.91% respectively. Yet it exists no statistical significance difference (p> 0.05) between the age groups. Similar findings were reported by Kassa and Yalew [20] and Tesfahewet and Simeon [21]. However, Bossena and Abdu [24] reported that exist statistical significance difference in the age group. But the prevalence of ticks in all the researchers indicated that very young animals are affected less than adult animals. This could be due to the less exposure to field grazing with other animals in the field.

Local breeds (80.46%) were affected less than the cross breeds (88.9%) but with no statistical significance differences (p>0.05). This result was disagreed with the

findings of Kassa and Yalew [20] who reported the prevalence of tick infestation was significantly higher (P<0.05) in local breed cattle (58.18%) than cross breed ones (10.55%) and Tamiru and Abebaw [2]. The burden of ticks on cattle had statistically significant difference (P<0.05) between local (mean=13.1 tick/head) and crossbreed (mean=21.4 tick/head) breed cattle. However, this finding agrees with the findings of Tamiru and Abebaw [2] in that the prevalence of ticks was higher in the cross breeds than local breeds.

The predilection sites of different tick species were varied this might be due to A variety of factors such as host density, interaction between tick species, time and season and inaccessibility for grooming determine the attachment site of ticks [13]. The predilection sites found in this study corroborate with those reported by other authors Seyoum [26] and Behailu [27].

CONCLUSION

The important and abundant tick species investigated in the study area were *R.* (*B.*) *decolaratus, R. evertsi-evertsi, R. simus, H. marginatum, H. truncatum, A. variegatum, A. cohaerence* and *A. lepidium*. The study indicated that there was high burden of ticks in the study area. However, the attention given to controlling the infestation had not been sufficient.

Generally, the distribution of ticks are not fixed but are determined by a complex interaction of factors such as climate, host density, host susceptibility, grazing habits and pasture-herd management. Therefore, effective tick control program should be formulated and implemented based on the distribution pattern of ticks and factors responsible for their distribution.

Recommendations: Application of acaroids to prevent and control ticks infestation should be implemented in a regular manner. Appropriate pasture management in communal grazing area is important. Further studies on factors affecting tick burden and tick control strategies as well as on tick borne diseases are recommended.

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