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Retrospective and Prospective Study of Ticks and Associated Risk Factors in Yabello District, Borana Zone, Oromia Regional State, Ethiopia

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Abstract: The retrospective and prospective study of ticks was conducted in Yabello district commencing from November 2018 up to April 2019. The study is aimed to judge the existing tick genera and the risk factors. Data were collected from selected study sites and animals diagnosed physically at the field and clinic post along clinical data records of three consecutive years. Clinical data records of 2016, 2017 and 2018 were included in retrospective study. The tick infestation in these consecutive years was 41 (11.99%), 39 (10.02%) and 35 (6.62%) respectively. In 2019 among 826 animals 10 (1.21%) were harboring ticks. Three representative pastoral associations Didhara, Yabello and Harboro kebeles are selected for ticks identifications at the genus level. Out of 1872 total ticks count the genus *Rhipicephalus* and *Amblyomma* constituted 95.19 % and *Hyalomma* 4.81%. All tick genera were collected during the dry season and from similar ecology; there were no statistically significant variation in tick infestation in three different pastoral associations. However, the result showed statistically significant variation ($P<0.05$) between age groups and sex. This study revealed as *Rhipicephalus* outnumber *Amblyomma* and both are important ticks in the area. Therefore, there should be strategic tick control method in Yabello pastoral area, while allowing maintenance of endemic stability.

Key words: *Rhipicephslus · Amblyomma · Hyalomma*

INTRODUCTION

Cattle play a significant role in the socio-economic life of the people of Ethiopia. In addition to the products of 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 [1, 2]

Ethiopia represents various climatic zones and livestock production systems in tropical Africa [3]. The total cattle population for the country is estimated to be about 52.13 million. Out of this total cattle population, the female cattle constitute about 55.57 % and the remaining 44.43 % are male [4]. All these cattle are at risk from the effects of ticks and tick-borne diseases [5].

Oromia is one of the Nine National Regional States of Ethiopia, where livestock production is widely practiced. The region has different cattle breeds and Boran is the most popular breed of cattle in the southern lowland part of the region, particularly Borana zone. The Boran breed originally descended from the first introduction of zebu into Africa from West Asia. The breed established its presence first in the semi-arid and arid pastoral Borana plateau of southern Ethiopia. The Borana pastoralist community maintains it. Pastoral movements and migrations led to spread of the Ethiopian Borana to the eastern rangelands in Ethiopia as well as into northern Kenya and southwestern Somalia. The Orma Boran, the Somali Boran and the Kenya Boran have evolved from these migrations. The Borana is now considered to have distinct groups of unimproved and improved Borana breed [6].

The wide range of breeds and species that have evolved in various environments represent unique sets of genetic diversity. Genetic diversity has been defined as the variety of alleles and genotypes present in a population and this is reflected in morphological, physiological and behavioral differences between individuals and populations [7]. It is generally accepted

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that the highest amount of genetic diversity in the populations of livestock is found in the developing world where record keeping is poor and the risk of extinction is high and on the increase. Recently, loss of genetic diversity within indigenous livestock breeds has been a major concern [8]. Among the associated risk factors that was assessed the prevalence of the disease significantly varies with the breed and body condition of the animals. Even though the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. The most important constraints to cattle productions are widespread endemic diseases including parasitic infestation, poor veterinary service and lack of attention from government [1].

Characterization of livestock breeds is the first approach to a sustainable use of its animal genetic resources [9]. The first step of the characterization of local genetic resources is based on the knowledge of variation in the morphological traits [10]. Morphometric measurements have been used to evaluate the characteristics of various breeds of animals and could provide useful information on the suitability of animals for selection [11-16].

The Ethiopian Boran breed is one of the cattle breeds widely used in Ethiopia. The breed is well adapted to semi-arid tropical conditions, has a high degree of heat tolerance, is tolerant to many of the diseases prevailing in the tropics and has the ability to survive long periods of feed and water shortage [17]. The unimproved Boran is used in subsistence and semi-commercial systems of production in Ethiopia, Kenya and Somali where it is commonly called Borana, Boran and Awai, respectively [17].

In Ethiopia, pastoralist areas cover 60% of total landmass of the country and majorities are engaged in extensive livestock herding, which forms the backbone of national economy. The pastoralist groups managed 40% of the national cattle herd; and some 90% of the country's live animals for export [18].

From health constraints livestock are highly affected by ectoparasites mainly ticks and tick borne disease which directly affects the socio-economic development of poor farmers in the area. Additionally the absence of well established research regarding socio-economic and public health implication of tick and tick borne disease in the farm have a negative impact on food security, animal product and by products [19].

Ticks are responsible for direct damage to livestock through their feeding habits. The damage is manifested as hide damage, damage to udders, teats and scrotum, myiasis due to infestation of damaged sites by maggots and secondary microbial infections [20]. There are also productivity losses associated with the various tick species that can occur. These are not usually obvious to the communal or smallholder farmer, but are important if raising of cattle is done at a commercial level [21].

In tropical Africa, tick and tick borne diseases (TBDs) are economically very important diseases next to trypanosomosis [22]. Among 60 tick species found infesting both domestic and wild animal of Ethiopia, 30 species have been widespread and are important parasites of livestock [23] and causes significant economic losses to the livestock industry. The economic losses incurred from downgrading of hides and skins are enormous; its export yields foreign earnings of the country, second only to coffee [24].

Anaplasmosis, babesiosis, cowdriosis and theileriosis (*Theileria mutans*), together with a range of vector tick species, have been demonstrated to be important and streptothricosis (*Dermatophilus congolensis* infection) is becoming more important. Although East Coast fever (*T. parva* infection) and its vector *Rhipicephalus appendiculatus* have not been found, the relatively uncontrolled passage of livestock from the southern Sudan ensures a considerable risk [5]. Therefore, the present study was undertaken to determine the tick infestation and investigation of the existing ticks to genus level.

MATERIALS AND METHODS

Description of Study Area: The Borana people are part of the Oromo which are the largest ethnic group of Ethiopia. The Borana are pastoralist who travel long distances with their cattle and camels in search for scarce food in an arid environment. Their appearance is much more 'African' in the way that the women are dressed in the colorful cloths found at many other areas in Africa. Yaballo is the largest town in the Ethiopian Borana area, they are also found in northern Kenya. It is a good base to explore the area and the Saturday market is well worth a visit.

The study was conducted in Borana zone district namely, Yaballo. Yaballo (also spelled Yaballo, Yavello, Iavello) is a town in southern Ethiopia. An alternative name for this town is Obda, which is also the name of a nearby mountain. Located northwest of Moyale in the Borena Zone of the Oromia Region (or *kilil*), this town has a latitude and longitude of 4°53'N 38°5'ECoordinates and 4°53'N 38°5'E and an elevation of 1857 meters above sea level. It has been the administrative center of the Borena Zone since its division from Guji Zone in September 2002, as well as Yaballo woreda

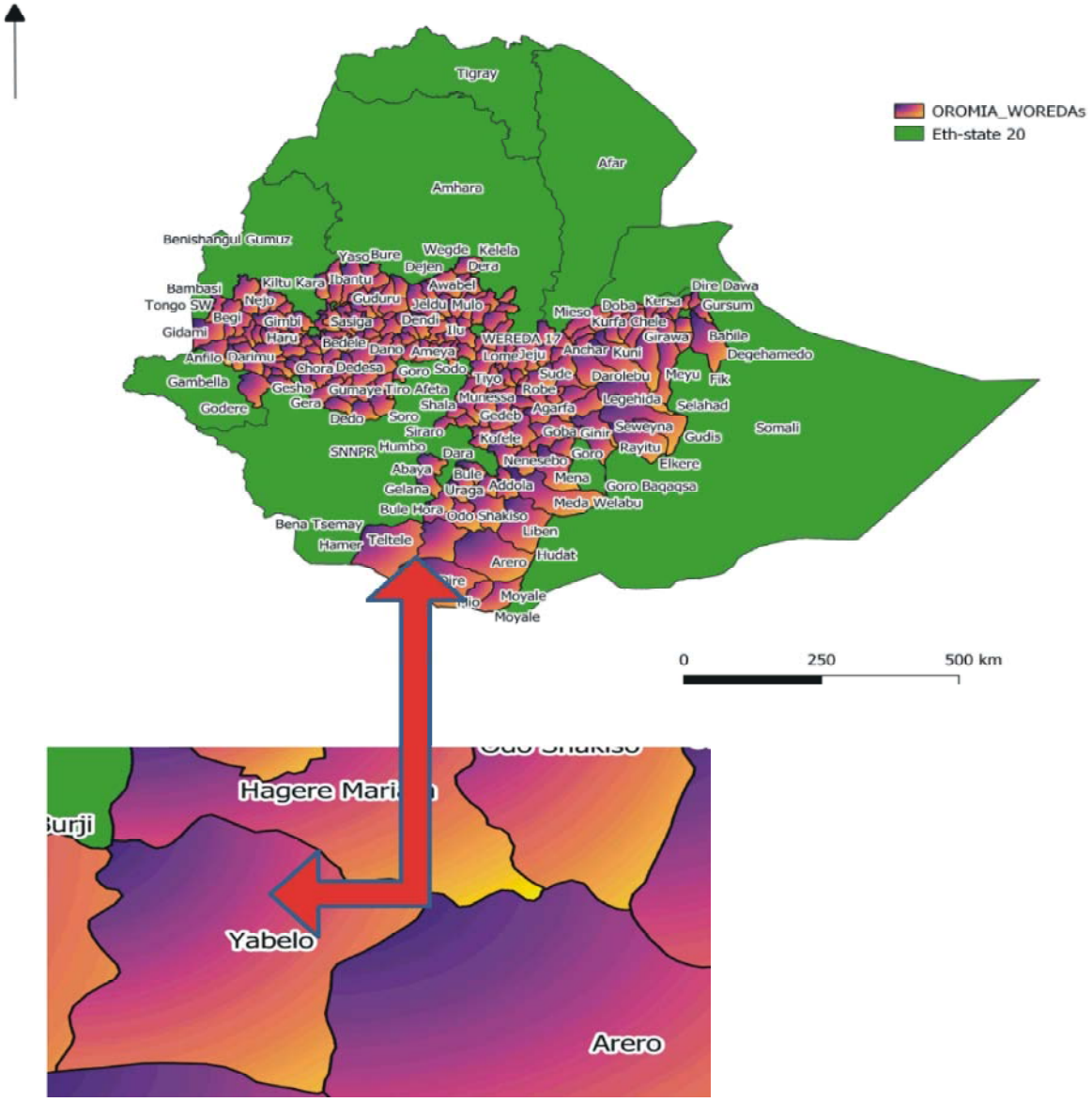

Fig. 1: Study area when represented by; QGIS 3.4.4 with GRASS 7.4.4 software

Study Population: Boran, a popular cattle breed, is predominantly utilized and widely distributed across various countries of Africa [6]. The Ethiopian Boran belongs to the group of Zebu cattle (Bos indicus), with their characteristic hump and pendulous dewlap. Available archaeological records indicate that zebu cattle are the most recent types of cattle to be introduced into Africa. Recent molecular genetics as well as archaeological evidences [25] also showed that the introduction of Zebu cattle into Africa centered in East Africa rather than through the land connection between Egypt and the Near East

The Boran cattle at present are found in the Ogaden, Sidama and Bale areas of Ethiopia and the adjoining regions of Somalia and Kenya. Boran cattle are reasonably large and have a good general body conformation. Their color is mainly white, light gray, fawn or light brown with gray, black or dark brown shading on head, neck, shoulders and hindquarters. The horns are thick at the base, very short, erect and pointing upward. The hump is well developed in the male, is of pyramidal shape and overhanging to the rear or to one side. The dewlap is well developed. In the male, the perpetual sheath is pendulous while in the female, the udder is well developed.

Average wither height is 118 to 124 cm in males and 116 to 120 cm in females. Body weight ranges from 318 to 680 kg in males and 225 to 454 kg in females [26].

The study was carried out on different cattle herds belonging to Yaballo. One hundred thirty two indigenous cattle of different age group and sex were used for adult tick survey during dry season. For convenience, cattle were divided into two age groups such as young and adult [27].

The Borana Range Land: The main habitat of the Ethiopian Boran is the southern rangelands of Ethiopia, around Liben, Mega and Arero plains. The climate is semi-arid to arid and water is scarce. However, the pastures are very productive, despite the recurring droughts. The breed is basically a beef animal, with large and wide frame; weighs up to 500 kg; it is also a good milker providing most of the staples for the Borana pastoral community. Livestock are major source of livelihood for the Borana pastoralists. The livestock population in the Zone is composed of 1, 771, 589 cattle, 1, 991, 196 goats, 699, 887 camels and 52, 578 donkeys [28]. The area was formerly recognized as pure pastoralists but presently farming activities are gradually expanding into the rangelands. Bush encroachment and rangelands degradation are serious problems which affect the livelihood of the community. Yaballo district is characterized by a rather semi-arid climate. Annual mean daily temperature varies from 19 to 24°C. The average annual rainfall, as registered by the national Meteorological Service Agency of Yaballo station is 600 mm. The rainfall distribution is bimodal, but erratic and unreliable in distribution. About 59% of annual precipitation occurs from March to May and 27% from September to November [29].

Study Methodology: Retrospective and prospective case study of ticks and field visit to the pastoral associations and physical observations of cattle at watering points were involved along with taking the qualitative traits of individual animals at the clinic. Counting of ticks was done on one side of the animal and the counting was done according to the method of Londt, Horak & de Villiers [30]. All adult ticks (both sexes) were collected in universal bottles and then the collected ticks were preserved in 70% ethyl alcohol and 10% Formalin as out lined [31]. Then they were identified to genus level by using a stereomicroscope according to standard identification keys given [32].

Statistical Data Analysis: The data was analyzed using SPSS version 20 Statistics and Pearson's Chi square tests was used to analyze the association between tick infestation and attributes of study animals such as age, sex, body condition and body color [33].

RESULTS

In this study, a total of 2086 heads of Borana cattle which were presented with different cases to the veterinary clinic from 2016- April 2019 were studied for the ectoparasite infestation by giving emphasis to tick and tick borne disease. Out of 2086 cattle presented cases to Yaballo Veterinary Clinic from 2016 to April 2019 about 142 animals were positive for ectoparasite infestations, out of this 125 (5.99%) (Table 1) cattle were diagnosed for tick infestation. During the current study, heavy tick infestations on the cattle were reported to be the most important livestock health problem of the area. In four years, including some months of the current year the number of animals diagnosed for the tick-borne disease was 19 (0.91%) which was not mentioned as a problem in the area.

There were 142 heads of cattle that were infested by ectoparasite in four study years. Among the ectoparasite infested cattle, tick infestation was the leading (88%). From 142 heads of cattle that were found to be infested by ectoparasite in four consecutive years, there was no significant difference in the number of animals infested by ectoparasites from one year to the other year except in 2019 when the least number only (10) were observed. This might be attributed to the few months of study period in 2019.

The age categories of the ectoparasite infested animals were adult and young. From 142 heads of cattle which were infested by ectoparasite, 121 (85.2%) animals were adult, while 21 (14.8%) (Table 5) of them were young. In our current study, out of 1872 collected ticks, 1220 (65.17%) were from the adult, while 652 (34.83%) were from the young animals. In addition, 1004 (53.63%) ticks were collected from females, while 868 (46.37%) (Table 8) ticks were from male cattle.

During this study, a total of 132 cattle were examined, of which 30 animals were found to be infested with different genera of ticks. The research work revealed that about 22.73% cattle were found to be infested with ticks, of which *Rhipicephalus, Amblyomma, Boophilus and Hyalomma* were identified. Out of 1872 ticks collected were *Rhipicephalus, Amblyomma* and *Hyalomma*; 1118 (59.72%), 664 (35.47%) and 90 (4.81%) respectively

Table 1: Number and percentages of animals presented to the veterinary clinic from 2016 to April 2019

Year	Tick Infestation	Tick-borne disease	Total animals presented to the vet. Clinic
2016	41 (11.99%)	8 (2.34%)	342
2017	39 (10.02%)	8 (2.06)	389
2018	35 (6.62%)	2 (0.38%)	529
2019	10 (1.21%)	1 (0.12%)	826
Total	125 (5.99%)	19 (0.91%)	2086

Table 2: Association of the host body color with the tick infestation from 2016 to 2018

		Tick infestation		
Body color		Positive	Negative	Total
White	Count	70	7	77
	% within body color	90.9	9.1	100
	% within tick infestations	56.0	41.2	54.2
	% of Total	49.3	4.9	54.2
Gray	Count	39	6	45
	% within body color	86.7	13.3	100.0
	% within tick infestations	31.2	35.3	31.7
	% of Total	27.5	4.2	31.7
Red	Count	10	2	12
	% within body color	83.3	16.7	100.0
	% within tick infestations	8.0	11.8	8.5
	% of Total	7.0	1.4	8.5
Black	Count	6	2	8
	% within body color	75.0	25.0	100.0
	% within tick infestations	4.8	11.8	5.6
	% of Total	4.2	1.4	5.6
Total	Count	125	17	142
	% within body color	88.0	12.0	100.0
	% within tick infestations	100.0	100.0%	100.0%
	% of Total	88.0	12.0	100.0

Table 3: The association between tick infestation and the sex from 2016 to 2018

		Tick infestation		
Sex		Positive	Negative	Total
Male	Count	46	10	56
	% within sex	82.1%	17.9%	100.0%
	% within tick infestations	36.8%	58.8%	39.4%
	% of Total	32.4%	7.0%	39.4%
Female	Count	79	7	86
	% within sex	91.9%	8.1%	100.0%
	% within tick infestations	63.2%	41.2%	60.6%
	% of Total	55.6%	4.9%	60.6%
Total	Count	125	17	142
	% within sex	88.0%	12.0%	100.0%
	% within tick infestations	100.0%	100.0%	100.0%
	% of Total	88	12	100

Table 4: The association between tick infestation and the body condition score of the host from 2016 to 2018

		Tick infestation		
Body condition score		Positive	Negative	Total
Good	Count	35	4	39
	% within body condition score	89.7%	10.3%	100.0%
	% within tick infestations	28.0%	23.5%	27.5%
	% of Total	24.6%	2.8%	27.5%
Moderate	Count	28	2	30
	% within body condition score	93.3%	6.7%	100.0%
	% within tick infestations	22.4%	11.8%	21.1%
	% of Total	19.7%	1.4%	21.1%
Poor	Count	62	11	73
	% within body condition score	84.9%	15.1%	100.0%
	% within tick infestations	49.6%	64.7%	51.4%
	% of Total	43.7%	7.7%	51.4%
Total	Count	125	17	142
	% within body condition score	88.0%	12.0%	100.0%
	% within tick infestations	100.0%	100.0%	100.0%
	% of Total	88	12	100

Table 5: The association between tick infestation and age from 2016 to 2018

		Tick infection		
Age		Positive	Negative	Total
Adult	Count	106	15	121
	% within age	87.6%	12.4%	100.0%
	% within tick infestations	84.8%	88.2%	85.2%
	% of Total	74.6%	10.6%	85.2%
Young	Count	19	2	21
	% within age	90.5%	9.5%	100.0%
	% within tick infestations	15.2%	11.8%	14.8%
	% of Total	13.4%	1.4%	14.8%
Total	Count	125	17	142
	% within age	88.0%	12.0%	100.0%
	% within tick infestations	100.0%	100.0%	100.0%
	% of Total	88	12	100

(Table 8). From total count, 646 (34.51%), 632 (33.76%) and 594 (31.73%) were from Did-hara, Harboro and Yaballo Pastoral Associations at the watering sites and there is no difference between the peasant associations (P>0.05).

Table 6: The relation between tick infestation and tick born disease from 2016 to 2018

		Tick borne disease		
Tick infestation		Positive	Negative	Total
Present	Count	17	108	125
	% within tick infestations	13.6%	86.4%	100.0%
	% within tick borne disease	89.5%	87.8%	88.0%
	% of Total	12.0%	76.1%	88.0%
Absent	Count	2	15	17
	% within tick infestations	11.8%	88.2%	100.0%
	% within tick borne disease	10.5%	12.2%	12.0%
	% of Total	1.4%	10.6%	12.0%
Total	Count	19	123	14
	% within tick infestations	13.4%	86.6%	100.0%
	% within tick borne disease	100.0%	100.0%	100.0%
	% of Total	13.4	86.6	100

Table 7: The total tick count from different pastoral associations and its percentage from the total count by 2019

	Tick count per pastoral associations			
Tick genera	Harboro	Did-hara	Yaballo	Tick genera in percentage from total count
Rhipicephalus	33.99% (380)	34.53% (386)	31.48% (352)	(59.72%) 1118/1872
Amblyomma	33.73% (224)	34.34% (228)	31.93% (212)	(35.47%) 664/1872
Hyalomma	31.11% (28)	35.56% (32)	33.33% (30)	(4.81%) 90/1872
Total	33.76% (632)	34.51% (646)	31.73% (594)	100% (1872)

Table 8: The total tick count from adult and young, male and female animals in 2019 (from the prospective data)

			Total count, percent and animal Sex (n = 132)		
Tick genera	Tick count in adult	Tick count in young	Female	Male	Total
Rhipicephalus	67.98% (760)	32.02% (358)	604 (54.03%)	514 (45.97%)	1118 (59.72%)
Amblyomma	60.54% (402)	39.46% (262)	346 (52.11%)	318 (47.89%)	664 (35.47%)
Hyalomma	64.44% (58)	35.56 (32)	54 (60%)	36 (40%)	90 (4.81%)
Total	(65.17%) 1220	34.83% (652)	1004 (53.63%)	868 (46.37%)	1872 (100%)

n = number of cattle infested by tick

Risk Factors: In this study the body condition score of the cattle population was found to be variable among tick infestation. Accordingly, Table 4 the percentage within tick infestation in poor body condition cattle is (49.6%, n= 62) out of the total 125 tick infested cattle which is by far more than that of cattle having moderate (22.4%, n = 28) and good body condition (28%, n = 35). On the other hand, the percentage within tick infestation between different age groups shows that there is high percent of ticks in adult (84.8%) cattle, than in young which was 15.2%.

Sex: Comparison was made on the percentage of tick infestation between female and male from ectoparasite infested animals. Out of animals sampled, the majority (60.6%, n = 86) were females, while 39.4 %(n = 56) were males. The percentage of tick infestations in female and males from tick infested cattle were 63.2% (79/125) and 36.8% (46/125) respectively. However, there was no statistical significance difference between the two sex (P = 0.75) (p > 0.05). This might be due to the small size of male compared to the females as the number of male in the herds of Borana cattle is minimal due to their utilization as cash income and small numbers of males for breeding are maintained while others were sold for efficient utilization of the scarce resource and to minimize risks.

Age: Analysis of age revealed (Table 5) the percentage within tick infection among the two age groups were relatively high in adult than the young which was 84.8 % in adult and 15.2% in young age category. But there was no statistically significant difference between the two age groups, this might be due to the existence of large number of adult animals compared to young ones and pastoralists lack the habit of getting treatment for their animals (P = 0.75, df =1 and $x^2 = 0.14$) (P > 0.05). However, the current study revealed, as there is a significant variation in tick infestation between adult and young age animals.

Body Condition Score: As shown in the Table 4 above the body conditions of the animals were also considered during examination and animals were divided into three body condition scores as shown in the above. These are, good, medium or moderate and poor. Out of 142 cattle infested by ectoparasites 39 animals were in good body condition, out of which 35 (24.6%) were positive for tick infestation, 30 animals were in moderate body condition and out of this 28 (19.7%) animals were positive for tick infestation and the rest 73 animals were in poor body condition state and out of this 62 (43.6%) animals were positive for tick infestation. These result shows that body condition have significant relation with tick infestation that cattle in good body condition were less affected by tick than the cattle in poor body condition and in medium body condition.

Body Color Pattern: Table 2 revealed that the body color pattern of the ectoparasite infested cattle were divided into four. These are, white, gray, red and black. Out of 142 animals infested by ectoparasites 77 animals were white in body color and out of this 70 were positive for tick infestation, 45 animals were gray in body color and out of this 39 were positive for tick infestation, 12 animals were red in body color and out of this 10 animals were positive for tick infestation and the rest 8 animals were black in body color pattern and 6 of them were positive for tick infestation, with no significance deference statistically ($P = 0.6$, $df = 4$, $x^2 = 2.225$) ($P > 0.05$).

DISCUSSION

The study was on adult ticks, as they are believed to be the most important ectoparasite stage in causing reduced productivity in Norval, *et al.* [34]. They are also more visible, easier to collect. In general. *Bos indicus* cattle are more resistant to tick infestations as compared with *Bos taurus* breeds and their crosses. However, the level of tick burdens observed in the present study on Borana cattle, a *B. indicus* breed was high. Previous studies have indicated that Borana cattle are not as tick resistant as other Ethiopian *Bos indicus* cattle [35, 36]. However, there was no number reported by the authors.

In this study, the tick infestation of animals shown in the Table 1 revealed that 5.99 % (2086) in four study years. The tick infestation of animals in four consecutive years revealed the decrement in percent (percentage of animals that were infested). The decrement ranges from 11.99 % in the 2016 to 1.21 % in 2019. This decrement in the infestation of animals by the tick and in 2019 might be due to the involvement of only one season in 2019, which was a dry period in the study area.

During the study period a total of 1872 adult ticks belonging to genera of *Rhipicephalus* (59.72%), *Amblyomma* (35.47%) and *Hyalomma* (4.81%) were found on cattle in Yaballo district, particularly the three Pastoral Associations of the study area. In the previous studies almost similar result with greater frequency of *Rhipicephalus* was reported in these areas by Solomon and Kaya [36] as well as by Zeleke and Bekele [37] reported similar figure in eastern part of Ethiopia. This indicates that tick infestation is a serious problem in cattle which has a great impact on the livelihood of the pastoralists and on the economy of the country. In general our present study is in concrete agreement and very similar to the report made by Regassa [38].

The result of the current study on the adult tick investigation indicated that all the identified genera were distributed in all study sites in a closely similar manner and abundance. The identified tick genera were *Rhipicephalus*, *Amblyomma* and *Hyalomma,* this finding was similar with Rahmeto, *et al.* [39] investigation, who recorded the distribution of similar genus in two pastoral districts of Somalia regional state. Such closely similar occurrences of tick distributions in two districts was most likely associated with the fact that similar livestock rearing practice, environmental condition, vegetation coverage and presence of similar indigenous cattle breed in their two studied districts. Hence, these factors are found to be highly associated with the distribution, survival and development of ticks. It is a well established fact that climatic factors and cattle rearing and management practices of different breeds have a direct influence on the biology and ecology of ticks [39, 40] and also robustly agree with the fact that unrestricted livestock movement from area to area in search of water and grazing, is a common phenomenon in the area, that increases and promotes tick-host contact between and/or among different Pastoral Associations and districts. Thus, it is one of the underlying factors contributing for tick distribution similarities across the adjacent pastoral areas in southern and south eastern part of the country.

The genus, *Rhipicephalus* and *Amblyomma* was found to be the most abundant of all tick genera in Yaballo district in the present study, comprising 95.19% of the collected ticks in the study sites. The genus *Amblyomma* (35.47%) was the second most abundant tick in the area of study. The existence of *Amblyomma* species

including *A. variegatum* is an important risk factor as a vector for heart water or cowdriosis which is the most important tick borne disease for both exotic and cross bred cattle in the study area. This was substantiated by previous studies that it is an economically important vector [41]. Almost similar results have been reported by Tesfanesh Gebremichael [42] in North Omo and Mehari Birhane [38] in Awassa. From these studies it is well established that *A. variegatum* is the most common and widely distributed cattle tick in Ethiopia as narrated by solomoon and kaaya, [36]. *Amblyomma variegatum* is an efficient vector of *Cowderia ruminantum* and *T. mutans* and can cause greatest damage to skin and hide, due to its long mouth parts and reduce the value of hide on world market [43]. In addition, ulcers caused by this tick species are favorable site for secondary bacterial infection like *Dermatophilus congolensis,* which disturbs the host causing annoyance and economically devastating chronic disease with little response to antibiotic treatments [24]. In this study, the predominant tick genera was *Rhipicephalus* and high total count was observed which was 868 (46.37%) from the total count and it was in agreement with the report by [44] which were conducted in two districts of Borana Zone, Ethiopia. However, the current result is not in consent with that of Tamiru and Abebaw [45] that was under taken at Asella, in which *Amblyomma* accounts 60.1% and *Rhipicephalus* 37.4%. This variation could be due to climatic difference between their study area and that of the current study area. The study made by Endale[46] in cooler high land of West showa was similar to that of the study made at Asella by the above mentioned authors, but it is lacking agreement with that of the present finding in Yaballo district. The genus *Rhipicephalus* has one widely distributed species *Rhipicephalus pulchellus*, which is also called "Zebra tick", a three host tick species, are the most predominant ticks inhabiting dry, semi-arid and bush land and are found to be most abundant with marked seasonal changes. This finding for *Rhipicephalus* was in agreement with the earlier studies accomplished in the Rift Valley and eastwards [32], in the drier lowlands of Harar and in north eastern of Tigray [47].

This study has also revealed that the genus *Boophilus* as the third most abundant tick genera in the area, which is in line with the research result reported by Dinka [44] at Dirre and Yabello districts. The existence of the tick genera *Boophilus* in the present study area could be an indication for the risk of *Anaplasma marginale* and *Babesia bigemina* in cattlewhich are transmitted by *Boophilus decoloratus* as a vector whichis the most widespread tick genera in the country. Generally, *Rhipicephalus (Boophilus) decolaratu*s can transmit *Babesia begmina* and *Anaplasma marginale* to cattle and severe tick infestation can lead to tick worry, anorexia and anemia [24]. Our present finding is incoherent with the report in Rift Valley [43] and in Girana valley of North Wollo [48]. In contrary to our results [49] stated that *Boophilus* is often collected in Ethiopia and does not seem really abundant anywhere. This tick species is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually [41] and has similar distribution to *A. variegatum*.

In this finding, however, each identified tick genera was collected from both young and adult cattle; age and sex of cattle was found to be a risk factor for the variation of tick abundance and mean burden. The proportion of the overall tick count was relatively higher in adult (65.17%) and female cattle (53.63%) than in youngest (34.83%) and male (46.37%) out of the total 1872 tick collected. On the other hand it is a known fact that indigenous cattle which have been exposed to ticks and tick-borne diseases for a prolonged period of evolutionary time and have survived without major losses where the ecological relationships between them have not been disturbed. It is widely recognized that indigenous breeds are highly resistant to ticks and acquire immunity to tick-borne diseases if exposed to them at an early age. Young animals are also known to be more tolerant to most TBDs, deriving a degree of protection from their dams or from the natural resistance often possessed by young animals. Similarly in this current study the young cattle were found to be less susceptible than the older ones. Further, this finding is in agreement with the previous work [50] in Uganda and with that of Oshnavich [51]. This study revealed that tick infestation is abundant in female (53.63%) cattle than in male (46.37%). Thus, from the current study finding, it is vividly clear that tick infestation is an important cattle health constraint in Borana pastoral areas in general and particularly in Yabello district.

CONCLUSION AND RECOMMENDATIONS

Tick infestation was found to be one of the most important cattle health problems in Yabello area. Three tick genera, *Rhipicephalus*, *Amblyomma* and *Hyalomma* were identified during the study period and *Rhipicephalus* and *Amblyomma* were found to be the

most abundantly distributed ticks on cattle in Yabello. The skin damages were prevailed along the tick infestation. Therefore, there should be strategic tick control in Yabello pastoral area.

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