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Full Length Research Paper

Study on prevalence and identification of ticks in Humbo district, Southern Nations, Nationalities, and People's Region (SNNPR), Ethiopia

Pawlos Wasihun* and Derese Doda

College of Veterinary Medicine, Haramaya University, Haramaya, Ethiopia, P. O. Box 138, Dire Dawa, Ethiopia.

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The distribution and abundance of cattle tick species in Humbo woreda, Wolaita zone, was studied over a period of 6 months from November, 2011 to April, 2012. Adult ticks were collected from seven main body regions of 384 cattle which were under extensive management system. Out of the total of 384 cattle examined, 238 (61%) were found to be infested by one or more tick species. About 2,439 adult ticks were collected from the animal body parts and identified to genera and species level. Five tick species of three genera (*Amblyomma, Boophilus* and *Rhipicephalus*) were identified. The relative prevalence of each species was *Boophilus decolaratus* (30%), *Rhipicephalus evertsi-evertsi* (25%), *Amblyomma varigatum* (25%), *A. cohaerence* (11%), and *A. lepidium* (6%). The risk factors like sex and age of cattle did not show significant association with the infestation rate but there was association with both breeds and body conditions. The prevalence of tick infestation in medium body condition (78%), poor body condition (67%), and good body condition (57%) was found to be statistically significant ($p < 0.05$) among the three groups of body conditions. The prevalence of tick infestation was found to be statistically significant ($p < 0.05$) among the three breeds, with highest prevalence in exotic breeds (100%) than both cross (80%) and local breeds (58%). The result indicated that the favorable predilection sites of *Amblyomma* species are ventral body and perineum. *B. decolaratus* preferred dewlap, udder/scrotum, belly, leg/tail, head, and perineum. *R. eversti-evertsi* had a strong predilection sites for perineum, dewlap, udder/scrotum, and ears. The sex ratio of all tick species identified during this study periods was skewed towards male except for *B. decolaratus*. Considering the economic importance of tick and tick borne diseases (TBDs) in the Humbo district, also in the country, there should be country wide control strategy, taking into account acaricide residues in products.

Key words: Attachment site, cattle, Humbo woreda, ixodidae, prevalence, tick burden.

INTRODUCTION

Ethiopia, located in the horn of Africa, between latitude of 30 to 15°N of the equator and longitude 33 to 48°E, is an agrarian country with an estimated total land area of 1,101,000 km^2. The country has an extremely diverse topography, a wide range of climatic features and multitudes of agro-ecological zonations which makes the country suitable for different agricultural production system. This in turn has contributed to the existence of large diversity of farm animal genetic resources (Annon, 2004). The proportion of total population in agricultural sector is 82.4%. The country has the largest number of livestock in Africa, approximately 44.3 million cattle, 46.9 million sheep and goats, more than 1.0 million camels, 4.5 millions equine, and 40.0 million chickens (Community-supported agriculture (CSA), 2004). Among livestock, cattle play a significant role in socio-economic life of the people of Ethiopia.

Ticks are obligate, blood feeding ecto-parasites of

*Corresponding author. E-mail: pwasihun@yahoo.com.

vertebrates, particularly mammals and birds. It has been estimated that about 80% of the world population of cattles are infested with ticks. The lifecycle of ticks (both Ixodids and Argasids) undergo four stages in their development; eggs, 6-legged larva, 8-legged nymph and adult (Minjauw and McLeod, 2003). According to the numbers of hosts, Ixodids ticks are classified as one-host ticks, two-host ticks, three-host ticks and Argasids classified as multi-host ticks. In one-host ticks, all the parasitic stages (larva, nymph and adult) are on the same hosts; in two- host ticks, larva attach to one host, feed and moult to nymphal stage and engorged, after which they detach and moult on the ground to adult; and in three-host ticks, the larva, nymph and adult attach to different hosts and all detach from the host after engorging, and moult on the ground. In multi-host ticks (Argasids), a large number of hosts are involved and it is common to have five moults, each completed after engorging and detaching from the hosts (Taylor et al., 2007). Ticks are most numerous, particularly in tropical and sub-tropical regions, and their impact on animal health and production is greatest in these regions (Lefebvre et al., 2010). Ticks are usually relatively large and long lived, compared to mites, surviving for up to several years (Kettle, 1995). Ticks belong to the phylum Arthropod, class Arachnid, and order Acari. The families of ticks parasitizing livestock are categorized into two, the Ixodidae (hard ticks) and Argasidae (soft ticks). Though, sharing certain basic properities, they differed in many structures, behavioral, physiological, feeding and reproduction pattern (Urquhart et al., 1996). Ticks that are considered to be most important to domestic animals' health in Africa comprise about seven genera and forty species. Among these tick genera, the main ticks found in Ethiopia are *Ambylomma* (40%), *Boophilus* (21%), *Heamaphysalis* (0.5%), *Haylomma* (1.5%), *and Rhipicephalus* (37%) (De Castor, 1997; Minjauw and McLeod, 2003). Among these, *A. varigatum and B. decoloratus* are most important and widely distributed (Abebaw, 2004). *A. coherence, A. gemma, A. lepidium, Haylomma marginatum rufipes, H. truncatum, and R. evertsi* are also commonly found in Ethiopia (Pegram et al., 2004; Solomon and Kaaya, 1996).

Even though there are a number of studies on ticks and TBDs in many parts of Ethiopia, in some location, there was no previous study on tick and TBDs and even other parasitic diseases in Humbo district, Wolaita zone. Therefore, the objectives of this study are to estimate the prevalence of tick infestation of cattle in Humbo district and to identify the common tick species in Humbo district.

MATERIALS AND METHODS

Description of study area

Tick survey was conducted in Wolaita zone, particularly in Humbo district. The woreda is located 1100 to 2300 meter above sea level, 6° 40'N latitude and 37° 50'E longitude in South Nation Nationalities and People Regional Government (SNNPR), 350 km from capital city of Ethiopia (Figure 1). The climatic condition of the study area was a mean annual temperature of 22.0°C and mean annual rainfall of 1123.15 mm. The woreda has forty kebeles, with total area of 86,646 hectare (ha) which is 70% of lowland and 30% of midland. Out of the total area of the woreda, the agricultural land (38,481 ha), permanent trees (4,980 ha), forest (16.900 ha), grassland (6,581 ha), different sectors (7,194 ha), fertile land (5,140 ha) and marshy area (7,370 ha) were included. It is bordered on the South by West Abaya woreda, North by Sodo zuria woreda, East by Damote Woyde woreda, and West by Ofa woredas. The human population in the area is 152,495; which comprise 75,487 males and 77,008 females. The major crops grown in the study area are cereals such as teff, maize, sorghum, cotton and root crops like sweet potatoes, ensete, carrot and fruits like mango, avocado and banana (HDAB, 2011).

Study population

According to Humbo District Agricultural Beruea (2011), the livestock of Humbo district was cattle (74,713), sheep (13,108), goats (23,209), equine (9,736), and poultry (50,133). The study populations were constituted in all breeds but the mostly populated breed in the area was indigenous or local breeds kept under traditional management system.

Sampling design and sampling technique

A cross sectional study was conducted from November, 2011 to April, 2012 to determine the prevalence of ticks, and identification of species of ticks collected and labeled according to predilection site. All the animals selected as sampling unit were checked for any tick infestation based upon the numbers of ticks found on the animal and the study record period. Ticks were collected from ears, heads, dewlaps, belly/flunk, udder/scrotum, perineum and legs/tails in the separated sample bottles with 70% ethanol. In addition to the attachment site of tick in different body regions, the burden of ticks based on age, sex, body condition, and breeds of animals were determined.

Sampling methods and determination of sampling size

The cattle to be examined were selected by simple random sampling method, and multistage sampling strategy was used to determine appropriate sample size. The sample size was determined by using the formula given in Thrustifield (1995). The expected prevalence of Ixodidae ticks of cattle in Humbo woreda was assumed as 50%. The parameters used were 95% confidence interval and 5% desired level of precision. By substituting these values in the formula, the sample size taken was n = 384

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

Where n = sample size; P_{exp} = expected prevalence; d^2 = expected precision which is usually 5% (0.05).

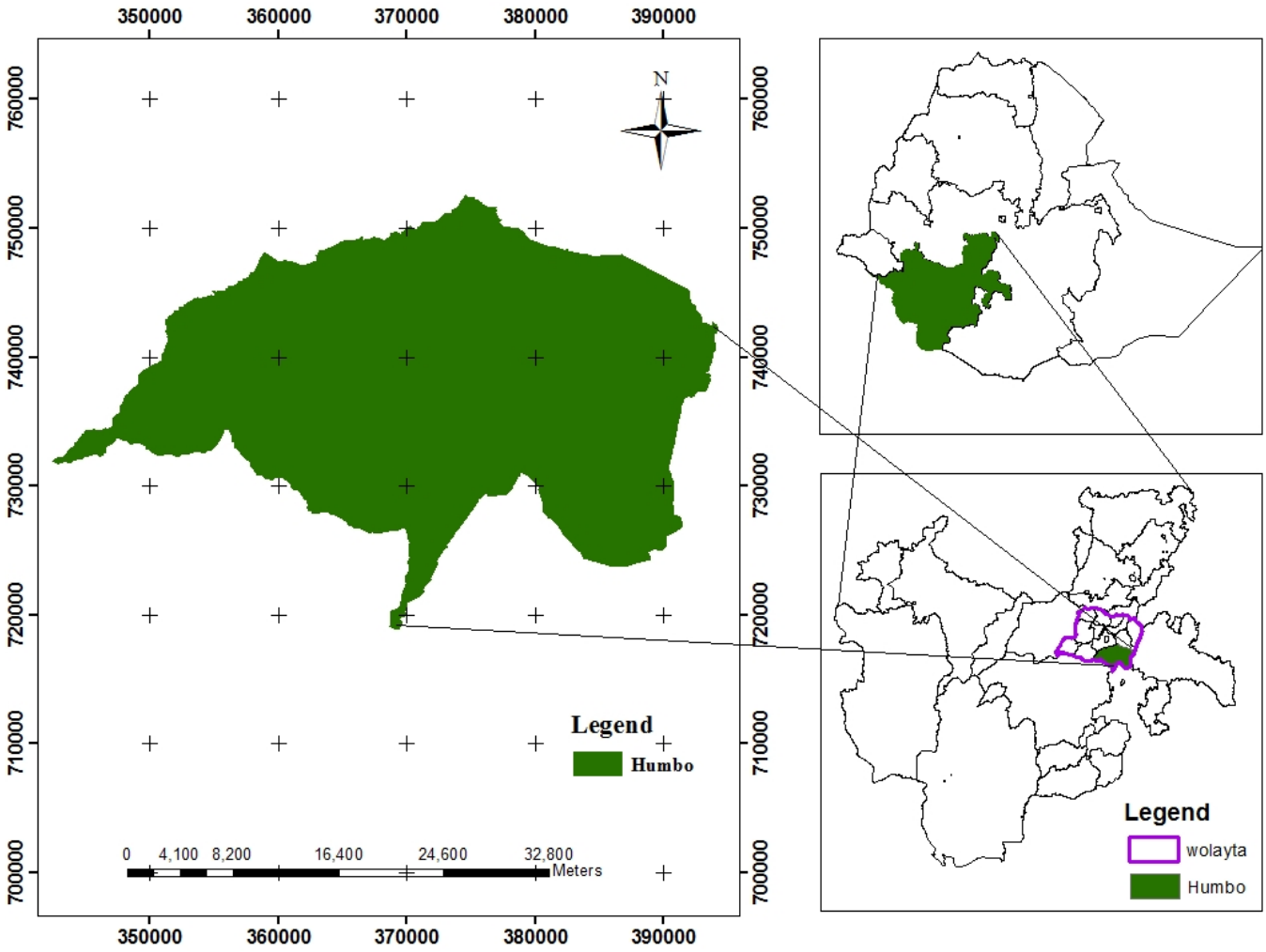

Figure 1. Map of study area.

Study methodology

Firstly, the selected study animal was properly restrained and all tick samples were collected from half the body regions. Ticks were removed carefully and gently in a horizontal pull to the body surface. The collected ticks were preserved in universal bottles containing 70% ethanol and labeled with respect to predilection site, age, sex and date of collection, then transported to Wolaita Sodo Regional Veterinary Laboratory for counting and identification. The ticks were counted and subsequently identified to genus and species level by using stereomicroscope, according to standard identification keys given by Walker et al. (2003).

Data analysis

The data collected were entered and managed in Microsoft-excel. An intercooled STATA 7 version software (Stata Corporation, 2001) statistical program was employed for the data analysis. The overall prevalence of tick was determined by dividing the number of positive animals by total sample size, and was expressed as percentage. Chi-square (x^2) test was used to assess if there was a statistically significant association in tick infestation between ages, sex, breeds and body conditions.

RESULTS

Prevalence of ticks on cattle in Humbo woreda

In this survey, a total of 384 animals where, local (n = 332), cross (n = 41), exotic (n = 11) breeds of cattle were examined. Then the overall prevalence was calculated by dividing the number of positive samples by the total sample size and multiplied by 100. Out of the 384 animals examined, ticks were found on 238 animals yielding an overall prevalence of 61.98%. The distribution of tick genera were identified and located in Table 1. The

statistical analysis was done for the prevalence of tick infestation with hypothesized risk factors (age, sex, breed and body condition).

There were statistically significant association with breeds (x^2 = 14.4791, p = 0.001) and body conditions (x^2 = 19.2801, p = 0.000) (Table 2).

Higher tick infestation rate was seen on both medium body condition and exotic breeds. There were no statistical significances (p > 0.05) associated with sex and age of animals (Table 3).

Identification of tick species and their abundance

Of the total 2,439 Ixodid ticks collected from seven body region of 384 cattles, five different species in three genera were indentified. The tick species identified were *B. decolaratus* (30.63%), *R. evertsi subspecies evertsi* (25.91%), *A. varigatum* (25.42%), *A. cohaerence* (11.36%), and *A. lepidium* (6.68%) in descending order of abundance (Table 5). By considering relative abundance of each tick species identified in the study area, *B. decolaratus* was the most abundant (30.63%) and *A. lepidium* was the least abundant (6.68%).

Predilection site of identified ticks

The observed proportion of tick species attachment site during this study was summarized and shown in Table 4. All three species of *Ambylomma* identified during the study preferred udder/scrotum, dewlap/brisket, perineum, belly/back, legs/tail and head regions. The *B. decolaratus* preferred the attachment site such as dewlap/brisket, belly/back, legs/tail, udder/scrotum, heads, ears, and perineum regions in decreasing order. The *Rhipicephalus* species were encountered mainly in the perineum, dewlap, udder/scrotum, ears, and belly/back and head regions.

Prevalence of tick species in relation to sex of ticks

The numbers of ticks collected from the cattle dominated by males but an exception was found in one host tick (*B. decolaratus)* in which females' collection was higher than the males' (Table 5).

DISCUSSION

The distribution and abundance of tick species infesting cattle in Ethiopia vary greatly from one area to another area. In this study *B. decolaratus* were found to be the most abundant tick species in Humbo district (30.63%). This is in agreement with Sileshi et al. *(*2007) who described that *B. decolaratus* is the commonest and most wide spread tick in Ethiopia, collected in all administrative regions except in the Afar region. This is also in line with Tamru (2008) in Asela, and Teshome et al. (1995) reported the highest prevalence of *B. decolaratus* (80%) in the study areas. According to Shiferaw (2005) *B. decolaratus* had highest frequency in the observed area during dry seasons (January, February and early March) in Wolaita zone. This result disagreed with the findings of Alekaw (1998) at Metekel Ranch, Ethiopia showing prevalence of 5.7%. This may be due to the geographical location and altitude factors which is 1,500 to 1,600 m above sea level of Metekel Ranch. The females were abundant from September to April and transmitted *Babesia bigemina* to cattle, and severe infestation can lead to tick worry, anorexia and anemia (Seyoum, 2005). The one-host ticks of the genus *Boophilus* that parasitize ruminants represent a hindrance to livestock farming in tropical and sub-tropical countries. They transmit the causative agents of anaplasmosis ("gall sickness") and babesiosis ("red water") in cattle (Walker et al., 2003).

R. evertsi-evertsi was found to be the second most abundant (25.91%) tick species in this study. The native distribution of *R. evertsi-evertsi* in Ethiopia seems to be connected with middle height dry Savannas and steppes, in association with zebra and ruminant and it is widely distributed throughout Ethiopia (Belew and Mekonnen, 2011). This tick species shows no apparent preference for particular altitude, rainfall zone or seasons (Pegram et al., 1981). The result of the current study was in line with Belete (1987) in Nekmet Awarja and Tessema region, and Gashaw (2010) in and around Asela, Hussen (2009) and Belew and Mekonnen (2011). According to Sileshi et al. (2007), *R. evertsi-evertsi* was collected throughout their study period, with the peak of abundance in January coinciding with the beginning of the rainy season and they also described that the discovery of this tick in that area was in line with its widespread occurrence in most parts of the country. The occurrence of this species in and around Wolaita zone was also reported by Dessie and Getachew (2006). *R. evertsi-evertsi* has short mouth parts with which to feed on soft area. As a result, it is a possible vector of *Babesia, Rickettsia* and *Theleria* (Kettle, 1995).*A. varigatum* was the third widespread tick species of the cattle in the current study area (25.42%). This result disagreed with different reports done by other authors in different parts of Ethiopia such as Tessema and Gashaw (2010) in Asela, Belew and Mekonnen (2011) in Holeta, Seyoum (2005), Mehair (2004) in Awassa who as described *A. varigatum* as the first most abundant tick species in their study areas. The difference in result was due to the geographical location where *A. varigatum* was found in highest number in the highland and high rainfall, and also due to its being relatively

Table 1. Distribution of tick genera of cattle in the study area.

Kebeles	Tick genera							
	Amblyoma		*Boophilus*		*Rhipicephalus*		Total	
	No.	%	No.	%	No.	%	No.	%
Abalala Faracho	239	54.07	98	22.2	105	23.76	442	18.12
Koysha Ogodama	114	39.18	103	35.4	74	25.43	291	11.92
Shocora Pisho	242	36.8	266	40.5	149	22.68	657	26.94
Demba Koysha	180	35.8	155	30.8	168	33.4	503	20.62
Humbo kebele 01	212	63.5	46	13.8	76	22.75	334	13.7
Humbo kebele 02	73	34.4	79	37.3	60	28.3	212	8.7
Total	1,060	43.46	747	30.63	632	25.91	2,439	100.00

Table 2. Prevalence of tick in relation to body conditions and breeds of animals.

Parameter	Body condition			Breed		
	Good	Medium	Poor	Local	Cross	exotic
No. of animal examined	239	89	56	332	41	11
Infested animals	129	71	38	194	33	11
Prevalence (%)	58.3	79.78	67.86	58.43	80.49	100

Body condition: $X^2 = 19.2801$, $p = 0.000$; Breed: $X^2 = 14.4791$, $p = 0.001$.

Table 3. Prevalence of tick in relation to body conditions and breeds of animals.

Parameter	Sex		Age	
	Male	Female	≤5 years	>5 years
No. of animal examined	213	171	144	240
Infested animals	134	104	87	151
Prevalence (%)	62.91	60.82	60.42	62.92

Sex : $X^2 = 0.1762$, $p = 0.675$; Age: $X^2 = 0.2387$, $p = 0.625$.

Table 4. Numbers of tick species identified in half body region of cattle.

Tick species	Body regions						
	Head	Ear	Dewlap	Legs/tail	Udder/scrotum	Perineum	Belly
A.varigatum	6	-	290	6	263	53	2
A.cohaerence	-	-	9	-	153	25	17
A.lepidium	-	-	58	-	95	10	-
B.decolaratus	24	17	450	74	66	16	100
R.evertsi-evertsi	2	31	112	-	55	425	7
Total	32	48	919	80	632	529	126

active throughout the year in most part of Ethiopia. *A. varigatum* is a widely distributed cattle tick in Ethiopia (Morel, 1980), and it is a potential vector of diseases caused by *Cowdria ruminantium, Theleria mutan, T.*

Table 5. The distribution and sex ration of adult tick species in the study area.

Tick species	Total count	Prevalence (%)	Sex		Ratio (male: female)
			Male	female	
B. decolaratus	747	30.63	5	742	0.007:1
R.evertsi-evertsi	632	25.91	563	69	8.2:1
A.varigatum	620	25.42	532	88	6.1:1
A.cohaerence	277	11.36	251	26	9.7:1
A.lepidium	163	6.68	137	26	5.3:1
Total	2,439	100.00	1448	951	1.5:1

velifera (“benign bovine thelieriosis”) and viral diseases, Nairob sheep disease, and also aggravates the situation of bovine dermatophilosis *(Dermtophilus congolence*) (Sileshi et al., 2007).

The study conducted in Wolaita zone by Dessie and Getachew (2006) showed that *A. varigatum* was the second abundant tick species at highland and midland, and the first abundant in the lowland during wet period. This variation may be due to the change in environmental conditions, with the result of global warming that highly affect the ecology of ticks. Change in temperature and rainfall have been reported to affect the distribution of diseases of vectors and tick borne diseases (Taylor et al., 2007).

A. cohaerence was the fourth abundant tick species (11.36%) in the study area. According to Dessie and Getachew (2006) *A. cohaerence* was also the fourth abundant tick species in the Wolaita zone with significant seasonal distribution variation at highland and lowland. This result was also similar with the reports of Belew and Mekonnen (2011) in Holeta, and Tessema and Gashaw (2010) in Asela. In tick survey conducted in western Ethiopia, *A. cohaerence* was found to be the most prevalent in Mezan Teferi (Seid, 2004) and Jimma (Yitbarek, 2004), with the prevalence of 50.5 and 83.1%, respectively. The prevalence of *A. cohaerence* is alarmingly important as this tick has been reported as a vector for *C. ruminantium* which is the causative agent of cowdriosis (“heart water”) (Sileshi et al., 2007).

A. lepidium was the least abundant tick species in the study area (6.68%). It is limited by semi-desert conditions (Morel, 1980). It is also known as the “East African bont tick” and is common in many of the semi-arid regions of East Africa (Walker et al., 2003). *A. lepidium* was common but not abundant in Wolaita zone according to Dessie and Getachew (2006) which is similar with the present finding that *A. lepidium* was the least abundant in the area. This is also similar with the findings of Mesele et al. (2010) in Bedelle district. In southwest of Ethiopia including Gambella region and western Oromiya, this tick species was also reported with less abundance by several workers (Mekonnen, 1995; Pegram et al., 1981; De Castor, 1994) that agree with the current result.In Gambella region, *A. lepidium* transmits *C. ruminantium*, *Rickettsial* organism that causes cowdriosis. *A. lepidium* was irregularly dispersed throughout most of the country and was collected from Tigray, Amhara, Oromiya, SNNP and Harare RegionalStates (Sileshi et al., 2007). Ticks are known to be distributed in different parts of the host’s body. In this study, the main infestation site of ticks in the body of hosts was dewlap, udder/scrotum, perineum, and belly. A variety of factors such as host density, interaction between tick species, time and season, and inaccessibility for grooming determined the attachment site of the ticks on the skins (Solomon et al., 2001). The predilection sites found in this study were in line with those reported by Seyoum (2001) and Behailu (2004) in their study conducted in North Wollo zone and Asela, respectively.

In this study, different animal related risk factors were studied to determine whether there is a significant variation in tick infestation between and among different groups of animals with suspected risk factors. The proportion of tick infestation was higher in adult animals as compared to young animals. However, there was no statistically significant association ($p > 0.05$), and the higher proportion may be due to outdoor management and long distant movement of adult animals to search for food and water compared to younger animals, so the chance of exposure is higher. This finding is also in agreement with the finding of Feseha (1997), Tessema and Gashaw (2010) and Belew and Mekonnen (2011) who stated a higher proportion in adult cattle.There was also statistically non-significant association ($p > 0.05$) in the infestation rate among different sex groups, where higher infestation was recorded in male animals compared to their counter parts. This variation may be associated with female animals which were kept properly in the house with good management system for dairy purpose whereas male animals grazing on field all day may be exposed to tick infestation. This result also agreed with the previous work done by other author

(Hussen, 2009) in Bako.

The proportion of tick infestation was higher in medium body conditioned (79.78%) as compared to poor body conditioned (67.86%) and good body conditioned animals (58%). This was due to the fact that medium body scored animals have reduced resistance and are exposed to any kind of disease when grazing on the field, and poor body conditioned animals were kept at home due to their inability to walk long distant areas, so they become less infested than medium sized animals but the well fed animals were very resistant to any kind of diseases when they grazed in the field or are kept at home.The fact that more tick burden was recorded in both exotic and cross breeds compared to local cattle would help in planning for tick control before the introduction of different improved breeds. In the past, attempts to introduce cattle of exotic inheritance into tropics have not had expected success. One reason for the failure could be because of the high susceptibility to ticks and TBDs of exotic and cross breeds. However, the fear of introducing susceptible cattle can be solved by introducing certain degree of resistance in these cattle by means of prophylactic treatment before introducing into enzootic areas (Solomon et al., 2001). This result is in agreement with Tessema and Gashaw (2010). In contrast, the report by Belew and Mekonnen (2011) revealed that the presence of tick infestation in local breeds were very high with the prevalence of 44.96% (n = 223), while in cross breeds and Jersey, the prevalence were 15.83% (n = 57), and 8.50% (n = 30), respectively. The significant variation in tick infestation of cattle of different breeds in their research might be attributed to different management system, lack of supplementary feeding for local breeds, or lack of control measures against tick on local breeds. Furthermore, it can be assumed that it might be due to lack of interest of farmers for local breeds as well as taking more care to cross and exotic breeds than local breeds.

The male to female rations of *B. decolaratus, R. evertsi-evertsi, A. varigatum, A. cohaerence* and *A. lepidium* were similar to previous reports (Seyoum, 2001; Solomon et al., 2001). Except *B. decolaratus*, all other species tick's males outnumbered females because males normally remain on the host longer than females. Fully engorged female tick drops off to the ground to lay eggs while male tend to remain on the host up to several months to continue feeding and mating with other females on the host before dropping off (Solomon et al., 2001). The females of *B. decolaratus* outnumbered males in this study probably due to small size of male which may not be seen during collection (Tessema and Gashaw, 2010).

Acaricide usage is still the main choice of tick control in the area. Currently organophosphate acaricides are most widely used chemicals. However, organophosphate resistance is emerging, especially in one-host ticks. Tick control can be also achieved by attacking one or more larval phase along the life cycle chain (Food and Agriculture Organization (FAO), 1984). In addition to acaricide application, appropriate livestock management, zero-grazing, up-grading of tick resistant cattle and implement traditional practices are quite important.Based on the information gathered during the study period from various cattle owners, infestation rate and tick burden increases after short rainy season (May to June) and decreased during long dry season (January to March). It is possible to indicate the trend of seasonality of tick population by comparing the number of ticks collected in the study period, there was a change in number of ticks from slightly wet months to the dry months, similar result were reported by Solomon et al. (2001), Tessema and Gashaw (2010) and Hussen (2009).

CONCLUSION AND RECOMMENDATIONS

Variable information on tick species distribution and dynamics are very essential to assess the economic loss encountered due to tick infestation and also to identify the appropriate measure of tick control. Among ecto-parasites, ticks cause the greatest economic loss in livestock population either by transmitting a wide variety of TBDs or by affecting the health of animals as well as the quality of hide and skins. The important and abundant tick species investigated in the study area were *B. decolaratus, R. evertsi-evertsi, A. varigatum, A. cohaerence,* and *A. lepidium*. The study indicated that there was high burden of ticks in the area. However, the attention given to controlling the infestation had not been sufficient. The control methods necessary for tick and TBDs were selection of tick resistance cattle, acaricides treatment, appropriate livestock management, evaluation and incorporation of traditional practices or remedies that appear to be of value.

In general, 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. In light of the above conclusion the following recommendations are forwarded:

1. Tick control program (application of acaricides) should be continued with an increasing frequency of application in wet months.
2. Detection of acaricide resistance tick species which are economically important since limited types of acaricides were used in the area.
3. More attention should be given to the selection of

resistance cattle breeds and types, and good performance with regards to production of local breeds.
4. Appropriate pasture management in communal grazing area is important.

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