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Survey on the Distribution of Tick Species in and Around Assosa Town, Ethiopia

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ABSTRACT

In this study, the distribution and abundance of bovine tick species in Assosa town was studied over a period of four month from December 2009-March 2010. Adult ticks were collected from seven main body sites of 384 local cattle which were under extensive management system. A total of 4163 adult ticks collected from half body part were identified, in which two species belong to *Amblyomma* and one species belong to each in genus of *Boophilus* and *Rhipicephalus*, of all the total tick collections, *Boophilus, Amblyomma* and *Rhipicephalus* constituted 45, 39.4 and 15.6%, respectively. The tick species encountered were *Boophilus decoloratus* (45%), *Amblyomma coherence* (24.4%). *Rhipicephalus evertsi evertsi* (15.6%) and *Amblyomma variegatum* (15%). The burden of ticks on cattle by their age group (<1 year, 1-3 year and >3 year) had statistically significant difference ($p<0.05$), with mean = 1.7, 7.8 and 16.9 tick/head, respectively in the study area. The study result indicates that the favorable predilection sites of *Boophilus* species are dewlap, back and hoof, *Amblyomma* species are found most of the time on ventral body part and hoof, because of long mouth part. Adult *Rhipicephalus evertsi evertsi* had a strong predilection site under tail as well as anovulval areas. The sex ratio of all tick species identified during this study periods were skewed towards male except for *Boophilus decoloratus*. In conclusion the infestation of ticks during the dry season is less then that of rainy season during which the activity of adult ticks becomes high.

Key words: Assosa, cattle, predilection site, prevalence, tick species

INTRODUCTION

The arthropods contain over 80% of all known animal species and occupy almost every-known habitat. As a result of their activity, arthropod ectoparasites may have a variety of direct and indirect effects on their hosts (Wall and Shearer, 1997). More than 850 species of ticks exists in the world and 60 different species of ticks are found in eastern Africa (Walker *et al*., 2003). Numerous genera of ticks serve both as vector and reservoir for Crimean Congo Hemorrhagic Fever virus (Telmadarraiy *et al*., 2008). Ethiopia, located in the horn of Africa between latitude 30 to 15°N of the equator and the longitude from 33 to 48°E is agrarian country with an estimated human population of about 62.9 million and a total land area of 1,101,000 km^2. The proportion of a total population in agriculture sector is 82.4% (CSA, 2002). The agricultural sector is characterized to a large extent by mixed farming system in which livestock play a vital role in the farming system of the country. According to CSA (2004), estimated livestock population of Ethiopia is about 30 million heads of cattle, 24 million sheep, 18 million goats 72 million equines, one million,

25 thousands pigs, 55.6 million poultry. Nevertheless, cattle productivity is low like other developing countries (Solomon *et al.*, 2001). Vector and Vector Borne Disease (VBD) are the major constraints to the development of viable livestock industries where ever they occur (Mekuria, 1987).

Tick and Tick Born Disease (TBD) are widely distributed through out the world particularly in tropical and subtropical countries, which cause a tremendous economic importance in live stock production (Kettle, 1995). In most parts of Africa, including Ethiopia tick and TBD, together with tsetse and trypanosomes are economically very important disease (Solomon *et al.*, 2001). Ticks are responsible for an arboviral zoonotic disease named Crimean Congo Hemorrhagic Fever (CCHF) which is asymptomatic in infected animals, but a serious threat to humans (Telmadarraiy *et al.*, 2008). According to Walker *et al.* (2003), ticks which are considered to be most important to the health of domestic animals in Africa comprise about seven genera. Among these tick general the main ticks found in Ethiopia include *Amblyomma, Boophilus, Haemaphysalis, Hyalomma* and *rhipicephalus*. And also there are 20 species of ticks exists on hvestock, all of which have damaging effect on production and productivity (Kassa, 2005). The most important and wide spread tick species are *amblyomma variegatum* and *boophilus decoloratus* (Abebaw, 2004). In addition to transmitting certain protozoan, rickettsial and viral diseases and predispose the animals to secondary bacterial infections (Bekele, 2002) and they damage hides and skins and interfere with meat and milk production. The most commonly known TBDs are anaplasmosis, babesiosis, theileriosis and heart water, ticks also cause non-specific symptoms like anemia, dermatitis, toxicosis and paralysis (Solomon *et al.*, 2001). Extensive surveys have also been carried out on the distribution of tick species on livestock in different regions of the country (Morel, 1989; Jewaro, 1986; Solomon and Kaaya, 1996; Solomon *et al.*, 2001). *Boophilus* exists in African countries, South of Sahara infecting cattle (Morel, 1980). In Ethiopia, it is prevalent in Gamo Gofa (Jewaro, 1986), Gondar (Eshetu, 1988), Bale (Dejenu, 1988). The highland area of Harar and Dire Dawa (Manueri and Tilahun, 1991), in Girana valley of North Wollo (Seyoum, 2001) and Keffa, Wellaga and Illubabor (DeCastro, 1994). *Amblyomma variegatum* is the most widely distributed tick species in Ethiopia (Morel, 1980; Pergam *et al.*, 1981; DeCastro, 1994). Other tick species such as *R. evertsi, Hyalomma marginatum rufipes, Hyalomma truncatum, Amblyomma coherence, Amblyomma gemina, Amblyomma lepidum* and *Rhipicephalus pulchellus* are also frequently reported in many tick survey carried out in the country (Solomon *et al.*, 2001). Ticks are common in all agro-ecological zones of Ethiopia (Pergam *et al.*, 1981). In addition to livestock having contact with man there are other risk factors. The habit of acarines on wall geckos, may pose a possible risk of zoonosis, if organisms are able to infest man and domestic animals (Ameh, 2005). Ectoparasites infesting dromedaries also posed significant public health hazard, especially in tick pestilence (Lawal *et al.*, 2007). On the study to evaluate for the first time the infectivity rate of *A. phagocytophilum* in *Ixodes ricinus* ticks collected from a suburban woodland area in the eastern part of Ghaemshahr City in northern Iran tick-borne Human Granulocytic Ehrlichiosis (HGE) was identified (Bashiribod *et al.*, 2004). Therefore, relevant data on the distribution of tick is essential for the development of effective tick and tick borne diseases control strategies. Studying ticks on livestock under their natural condition with out any control measure is also useful for understanding the host-parasite relation and variation of tick population in different agro ecological zone.

Therefore, the objectives of this study were to (1) determine the prevalence of bovine tick species with their favorable predilection site and the tick burden within groups of age and body condition in and around Assosa town and to generate base line data for effective control measure in the study site and (2) to aware the farmer on the significant role of the direct and indirect effect of ticks.

MATERIALS AND METHODS

The study was conducted in Assosa woreda, capital city of Benishangul Gumuze regional state. The town is located at about 659 km from the capital city (Addis Ababa). The region is found in the north west of the country at latitude 9 and 11°N and 34 and 35°E and altitude is 1401-1544 m above sea level. The average annual rain fall of the woreda is 1330 mm and annual ambient temperature varies from 21-31°C (CSA, 2004).

Study population: The livestock population of the area comprises about 26,124 cattle with (only 15 holeistine fresian and the rest local zebus) 4,382 sheep, 17,509 goats, 5,930 equines and 34,710 poultry (indicate the source). The study was carried out on cattle found in Assosa town. All cattle those are included in the study population regardless of their sex, age, breed, physiological and health status condition.

Study design: Cross-sectional study design was used to determine the distribution or prevalence of tick species in the study area, predilection site variations and the tick burden within (between) age, sex and body condition group (poor/good) (Meinon, 1989). Cattle were categorized based on their age (<1, 1-3 and >3 year) (De Lahunta and Habel, 1986).

Sample size: The sample size was determined by assuming the expected prevalence of 50% tick infestation. The desired sample for the study was calculated by setting 95% confidence interval at 5% absolute precision (Thrutfield, 1995).

- $n = 1.96^2$ Pexp (1-Pexp)/d^2
- n is required sample size
- Pexp is expected prevalence
- d is desired absolute precision
- n = Pexp------ (in this case 50%)
- d = ---------- (in this case 5%) therefore, $n = 1.96^2 * 0.5(1-0.5)/(0.05)^2 = 384$ cattle

Methods: Half body tick collections on alternative sides were made. The animals were properly casted and adult ticks were collected from 7 different sites of the body (dewlap, head, udder/scrotum, back, leg/hoof and tail). Adult ticks were collected and coded then it was preserved with prefilled 68% ethanol in universal bottle separately according to their site. Required information were like date of collections, place of collection, body site of collection, species and breed of host were recorded and then transported to Assosa regional Diagnostic and Research center laboratory, the ticks genus and species were identified under stereo microscope in the laboratory and the half body tick counts were doubled to obtain whole body tick burden according to (Keiser, 1987).

Tick identification: Investigation procedure required both field works and laboratory investigation of collected sample which seems the following. Adult ticks were collected from seven half body regions of cattle in to sample bottle containing 68% ethanol (Aerts and Neshem, 1999; Walker *et al.*, 2003). The half regions used for collections were dewlap, brisket and back, udder or scrotum, anogenital, leg and tail (Keiser, 1987). Ticks were removed from the host skin whilst retaining their good condition for identification using good steel forceps. The collected ticks from

each body regions were kept separately for identification in separate sample bottles. Then taken to laboratory to identify tick genera using stereo microscope based on tick identification keys of (Keiser, 1987; Mathysce and Colbo, 1987). Ticks were usually identified by the size and length of the capitulum, the color of the body, site preference and location on the host. Male and unengorged female ticks were easier to identify than engorged female ticks (Hendrix, 1998).

Data analysis: All raw data that was recorded from study area was entered in to Microsoft excel database system and analyzed using SPSS computer program. Chi-square test was used to determine the significant variation on tick burden among different age, sex and body condition groups. Descriptive statistics were used to show favorable predilection site of tick species.

RESULTS

A total of 4163 tick collected among which three genera and four species were identified. Higher prevalence was *Boophilus decoloratus* (70.3%) and the most abundant and widely distributed genus was *Amblyomma coherence* (39.3%), *Rhipicephalus evertsi evertsi* (30.5%) and *Amblyomma variegatum* (23.4%), respectively in the study site (Fig. 1).

Table 1 shows the distribution of *B. decoloratus* as the most abundant tick species 45% of the total collection of ticks. *A. coherence* was the second (24.4%) most abundant and widely distributed tick species of the total collection of ticks, *Rhipicephalus evertsi evertsi* is the 3rd widely distributed, it represented 15.6% and *Amblyomma variegatum* was the least abundant tick species (15%) out

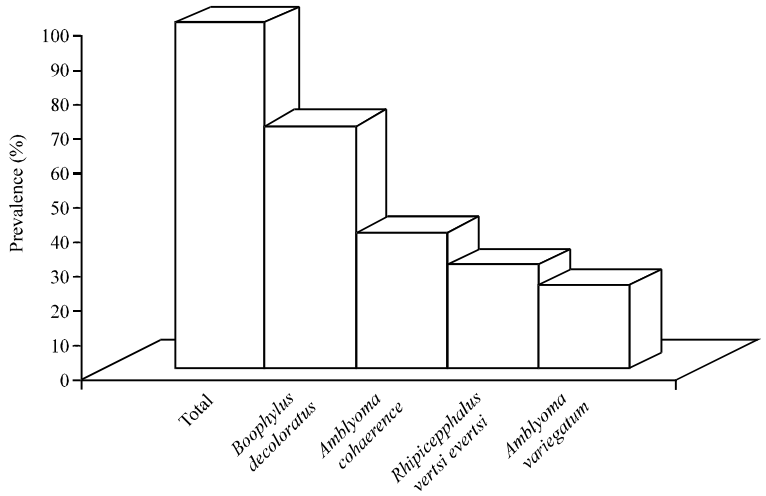

Fig. 1: Prevalence of tick species in and around Assosa town

Table 1: Distribution of tick species and favorable predilection site

	Total tick		
Tick species	No.	%	Predilection site
B. decoloratus	1881	45.0	Dewlap, back, head and hoof
A. coherence	1016	24.4	Dewlap, back, udder/scrotum
R. evertsi evertsi	644	15.6	Under tail and anovulva
A. variegatum	622	15.0	Back, udder/scrotum, dewlap
Total	4163	100.0	

Table 2: Prevalence of tick within age group

Age	No. of animal examined	No. of positive animal	No. of negative animal	Prevalence (%)
<1 year	44	10	34	22.7
1-3 year	182	140	42	76.9
>3 year	158	155	3	98.1

$\chi^2 = 1.210$, p = <0.05

Table 3: Prevalence of tick within body condition

Body condition	No. of animal examined	No. of positive animal	No. of negative animal	Prevalence (%)
Poor	185	182	3	98.4
Good	199	123	76	61.8

($\chi^2 = 78.463$, p = <0.05)

Table 4: Burden of tick within age and body condition

	<1 year	1-3 year	>3 year	Poor	Good
No. of animal	44	182	158	185	199
Examined					
Total tick	75	1411	2677	3016	1147
Collected					
Mean of tick	1.7	7.8	16.9	16.3	5.8
Burdeu					
Out of total (%)	2.6	36.4	40.4	47.4	32

of total. All ticks collected were from lowland, 1401-1544 masl. This study result indicated that the most favorable predilection sites for *Amblyomma* species were udder/scrotum, back, dewlap and hoof. While *Boophilus decoloratus* was collected mostly from dewlap, head and back. And adult *Rhipicephalus evertsi evertsi* had a strong predilection site for smooth skin under the tail as well as pre-anal and vulval areas.

In this study the difference on tick prevalence and burden between age group (Table 2 and 4) was found to be statistically significant ($p<0.05$) which was higher in age >3 years (16.9 tick/head) and low burden of tick seen in the age group <1 year, which is (1.7 tick/head). Calves are generally less infected than adult.

In Table 3 about 78.4% of the examined animals were found to be infested by ticks. The infestation level of ticks had statistically significant difference ($p<0.05$), between cattle with poor body condition (mean = 16.3 tick/head and df = 1 and good body condition (mean = 5.8 tick/head and df = 1. The prevalence is higher in poor body condition than good body condition.

The prevalence of tick in poor body condition is higher (47.4%) than good body condition (32%). The prevalence in age group >3 years is higher (40.4%) than age group 1-3 years (36.4%) and age group <1 year (2.6 %). Calves are less infected than all the age groups (Table 4).

DISCUSSION

The prevalence and distribution of the most common tick species infesting cattle is different from one area to another. In the present study, detailed investigation was carried out to identify and determine the type of species and predilection site of ticks infesting cattle in and around Assosa. Although, there are different species of ticks, only four species of tick, *B. decoloratus, Amblyomma coherence, Amblyomma variegatum* and *Rhipicephalus evertsi evertsi* were identified.

In this study *B. decoloratus* was found to be most abundant tick species in the region (45%). As studied by other authors in Tigray, higher abundance was reported in the lowlands (shire)

than highlands. In rift valley sites as studied by Solomon and Kaaya (1996), Hararghe (Gulilat, 1987), Bale (Dejenu, 1988), Girana valley North Wollo (Seyoum, 2001) and in the highland area of Harare and Dire Dawa districts (Manueri and Tilahun, 1991); Morel (1980) stated that *B. decoloratus* often collected in Ethiopia and are not highly abundant any where. The result of this study disagrees with findings of Morel (1980). *B. decoloratus* can transmit *Babesia bigemina* and *Anaplasma marginale* to cattle and cause severe tick infestation that leads to tick worry, anorexia and anemia (Mekonnen *et al*., 2001).

Amblyomma coherence was found to be the second abundant tick species (24.4%) in the present study; in western Ethiopia, where the climate is humid much of the year. *Amblyomma coherence* is the most prevalent and abundant tick on cattle (Pergam *et al*., 1981). In tick survey conducted in western Ethiopia by Seid (2004) in Mizan Teferi and Yitbarek (2004) in Jimma was found to be the most prevalent in the area with a prevalence of 50.5 and 83.1%, respectively and also others authors like Tamru (2008) in Assela indicated that the prevalence of *Amblyomma coherence* was 11.9 and 2%, respectively. *Amblyomma coherence* transmits Ehrlichiosis, but less important vector than *A. variegatum* (Solomon *et al*., 2001). Another report indicated spontaneous infection of *Amblyomma coherence* by *Rickettsia conorii* in Ethiopia (Morel, 1989).

Rhipicephalus evertsi evertsi was the third abundant (15.6%) and widely distributed tick species in the present study. This tick specie is reported to be prevalent by other authors which is in line with the present study result such as in Bahir Dar (Mesele, 1989) and Asella Behailu (2004), Morel (1980) confirmed that the native distribution of *Rhipicephalus evertsi evertsi* in Ethiopia seems to be connected with middle height dry savannas, bamboo and steppes in association with ruminant. The most abundant species with no marked seasonality (Yehulashet *et al*. (1995), Assela (Tamru, 2008). This study agrees with previous studies and *Rhipicephalus evertsi evertsi* is associated with lamb tick paralysis (Morel, 1980; FAO, 1984).

Amblyomma variegatum is most common tick species infesting cattle and horses. In this study *A. variegatum* were found to be the fourth abundant tick species in the region (study site) (15%) and reported by other authors in different parts of Ethiopia such as North Omo (Tesfanesh, 1993), Bahir Dar (Mesele, 1989), Awassa (Mehari, 2004) and Assela (Behailu, 2004). *A. variegatum* is widely distributed cattle tick in Ethiopia (Morel, 1980; Pergam *et al*., 1981) and heavy infestation of *A. variegatum* was recorded in Shoa, western part of wallega and in shire lowlands of Tigray (Morel, 1980).

Among the tick species found *A. variegatum* causes the greatest damage to hides and skin because of its long mouth part which renders the commodity value less on world market if the tick are large in number (Solomon *et al*., 2001), ulcer caused by this tick species are favorable sites for secondary bacterial infection like *Dermatophilus congolensis* (Kaufman, 1989). *A. variegatum* can play in Epidemiology of Epizootic lymphangitis in tick infested horses and frequent association of skin abscesses, due to *Corynebacterium pyogenes* (Morel, 1980).

In this study the distribution of *B. decoloratus* was the most abundant tick species 45% of the total collection of ticks. *A. coherence* was the second (24.4%) most abundant and widely distributed tick species of the total collection of ticks, *Rhipicephalus evertsi evertsi* is the 3rd widely distributed, it represented 15.6% and *A. variegatum* was the least abundant tick species (15%) out of total. All ticks collected were from lowland, 1401-1544 masl.

This study result indicated that the most favorable predilection sites for *Amblyomma* species were udder/scrotum, back, dewlap and hoof. While *B. decoloratus* was collected mostly from dewlap, head and back. And adult *Rhipicephalus evertsi evertsi* had a strong predilection site for smooth

skin under the tail as well as pre-anal and vulval areas in the study area which coincides with the distribution of ticks on the cow body surface in inguinal region (50.26%), perineum (30.1%), breasts (15.87%) and testis (3.7%) (Davoudi *et al.*, 2008).

Predilection sites mentioned in this study result corporate with those reported by other authors (Mesele, 1989; Behailu, 2004; Seyoum, 2001). A variety of factors such as density, interaction between tick species, time and season and inaccessibility of the attachment site of ticks affect the skin (Solomon *et al.*, 2001).

The study also shows that the effect of tick on different body condition, were statistically significant, ($p<0.05$, $\chi^2 = 78.463$ and df = 1). The infestation level of ticks were higher in the poor body condition (mean = 16.3 tick/head and df = 1 than good body condition (mean = 5.8 tick/head and df = 1) animals. The observation indicates that poor body conditioned animals are less resistant to tick infestation and lack enough body potential to build resistance with age advancement. Several authors have reported high infestation of tick result poor body condition due to consumption of high amount of blood and fluid by those ticks (Southerest, 1983). Aerts and Neshem (1999) who reported that the British cattle breeds having the lowest body condition score under tropical conditions had the highest infestation of ticks. Seid (2004), Southerest (1983) and Bianchi *et al.* (2003) reported that tick load on animal is affected by breed and nutritional stress. Ultimately, these factors affect general body condition, which in turn affects blood composition, respiratory rate, appetite and eventually leads to poorer body condition scores. This present study is agreed with previous studies above mentioned. The effect of age on the burden of ticks were statically significant ($p<0.05$, $\chi^2 = 1.210$ and df = 2) influenced by the age of the animals with older animals having high tick infestation than younger, (Southerest, 1983) who observed that adult cattle presented higher burdens of *Boophilus* than calves. However, in the study by Taylor (2006) both the climatic differences between the two years of the trial and the cattle raising techniques adopted on the ranch in their study could have contributed to the lower infestations seen on the young animals. The calves were maintained apart from adult animals at population densities and were thus possibly exposed to lower parasite burdens on the pasture (This may be due to management system, that means in age less than one year has less tick infestation and animal with age>3 years has high tick infestation. However, calves graze around home that means the pasture cannot be infested by ticks, no more animal graze around it and most of the time they are zero grazing. Calves are generally more resistant to infection of tick than adult (Feseha, 1983; Morel, 1989). These present studies agree with the above idea of authors, but disagree with Tamru (2008), at Assela there is no significance with in any age group.

But the effect of sex on the burden of tick were statistically significant ($p<0.05$, $\chi^2 = 0.183$, df = 1). The result also agree with previous research done by other authors like in Bako (Morel, 1989).

Based on observations during 4 months and information gathered from various cattle owners' infestation rate and tick burden decreases during long dry season from November/January to March and increases after short rainy season. It is possible to indicate the trend of seasonality of tick population by comparing the number of tick collected in these months, there is change from slightly wet month to the dry month, similarly it was reported by Feseha (1983), Solomon *et al.* (2001) and Alekaw (1998). Similar to the findings in West Azerbaijan the higher infestation rate belongs to spring while the lowest one refers to winter and summer for cows and buffaloes, respectively, hence revealing significant meaningful relation between the abundant presence of tick and seasons (Davoudi *et al.*, 2008). Infestation by ticks during the dry months is at very low level and during the rainy season the activity of adult tick becomes high.

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