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Epidemiological Study of Ticks and their Distribution in Decha Woreda of Kafa zone, SNNPRS

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ABSTRACT

An epidemiological investigation of tick parasites was undertaken from September 2004 to March 2005 in Decha woreda of Kaffa zone, Southern Nations and Nationalities of People's Regional States (SNNPRS). The study was conducted with the aim to determine the distribution, prevalence and seasonal variation of cattle tick species through cross sectional and longitudinal epidemiological study methods. A combination of sampling techniques was used to identify sampling units. A total of 480 cattle equally distributed to each stratum (160 cattle from highland, midland and lowland) were subjected for sampling. Furthermore, out of 160 cattle, 40 were randomly selected for longitudinal study from each agro-ecological zone.

The result found shows that all examined cattle from lowland were positive for tick infestation followed by animals from midland and highland areas with 100%, 92.5% and 68.12% prevalence, respectively. Though the difference is not statistically significant between animals with different body conditions, the proportion of infested animals appear to be higher in animals of poor body condition (90.91%) than those in good body condition (85.16%). A significant variation ($p<0.05$) in prevalence of tick infestation was noted between different age groups, the highest being in animals with 3 and half years as well as of 4 years old. A total of 4337 adult and immature ticks belonging to three genera were collected during the cross sectional study. Five tick species belonging to three genera (*Amblyomma, Boophilus and Rhipicephalus*) were identified. The most prevalent and abundant tick species was *B. decoloratus* (46.57 %) followed by *A. cohaerens* (22.53%) from the total count. Other tick species collected in small numbers were *A. lepidium* (1.15%), *R. praetextatus* and *R. e. evertsi* (0.14%). Immature ticks were also included in our collections representing a total amount of (28.89%) from the total count. Result of estimates of mean tick burden indicated that except among the different age groups, there is a significant difference between different geographical zones, season and body condition ($p<0.05$). The mean tick burden is significantly higher in midland altitudes (22.986), early rainy season (20.713), and in those animals with poor body condition (19.532).

Keywords: Epidemiology, tick, cattle, Decha Wereda, Southern Ethiopia

INTRODUCTION

Ethiopia's economy is dominated by the agricultural sector, which contributes about 46.9% of the GDP and employs 85% of the labor force. Besides supplying most domestic food requirements, agriculture provides raw materials for secondary industries and accounts for about 90% of the exports; livestock are an important component to nearly all-farming systems and provide draught power, milk, meat, manure, hides, skins and other products. The size and diversity of Ethiopia's major agro-ecological zones render it suitable for the support of large numbers and classes of livestock. The limitation to increased livestock development (increased productivity) in Ethiopia can be grouped into non-technical and technical constraints. The non-technical constraints are policy issues, land tenure, institutional, infrastructure and budgetary. The major technical constraints include health, feed, genetics and management (Tick modeling workshop, 1997).

Ticks are the most important ecto-parasites of livestock in tropical and sub-tropical areas, and are responsible for severe economic losses both through the direct effects of blood sucking or indirectly as vectors of pathogens and toxin production. Ticks are a cause of much ill health to domestic animals and a cause of considerable economic loss to their owners. In the world, an estimate of US $ 7, 000

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million annual losses is caused by tick and tick-borne diseases (FAO, 1984); this estimate provides a guide to regions of the world where *Boophilus microplus* is the only major tick infesting cattle and this figure may indeed be much higher in regions where different tick species are present.

The major losses caused by ticks are due to their ability to transmit protozoan, rickettsial and viral diseases of livestock, which are of great economic importance worldwide (Galloway, 1974 and Jongejan and Uilenberg, 1994). Ticks and the diseases they transmit are widely distributed throughout the world particularly in tropical and sub-tropical countries with special nidality in Africa where there exist a varied fauna of vertebrate animals to their development (Hoogstraal, 1956; FAO, 1984 and Hendrix, 1998).

Each tick infesting an animal may suck out some 0.3 ml of the animal's blood. Even in animals such as zebu breeds that are resistant to ticks this may have a serious effect when the animal is suffering from a low level of nutrition or is pregnant (FAO, 1983). Experiments in Australia have shown that for each *B. microplus* female tick that completes feeding, there is a loss of 0.6g of potential growth by cattle (Walker *et al.*, 2003). There are a number of factors influencing the distribution of ticks, and various tick species have different biological requirement, different geographical distribution, host preference etc., identification is therefore important in the struggle against tick and associated diseases

Despite these problems, the achievement made on the study of tick in Ethiopia in general (except few areas) is not significant and does not cover all regions especially those marginal and remote areas where suitable environment as well as uncontrolled cattle movement exist. The present study is therefore conducted to assess the overall situation of tick in one of the remotest part of the country, Decha Wereda, Kaffa zone of Southern Ethiopia with the following specific objectives:

- To determine the type of tick species.
- To assess any risk factor associated with the occurrence and abundance of the tick species.

MATERIALS AND METHODS

Study Area

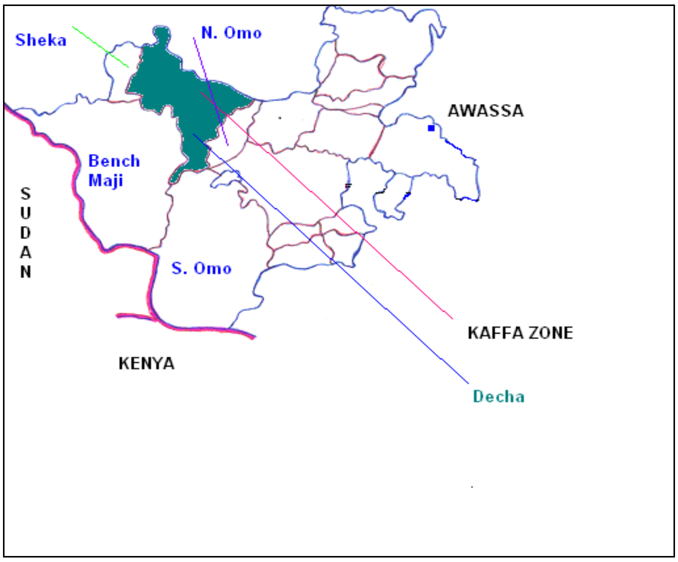

Figure1. *Map showing the different zones of Southern Nations and Nationalities people's regional state and the area where the study took place*

The study was conducted in Decha woreda which is located Southwest part of the country. Decha is one of the largest woredas of Kaffa zone comprising 46 kebeles. It shares borders with different zones and woredas such as Ginbo and Chena woredas in the North, Sheka zone in the Northwest, South Omo zone in the South, Bench Maji zone in the West, North Omo zone in the East and Cheta, Telo, Menjiyo woredas in the Northeast (figure 1). The woreda is situated 24 km from Bonga (zonal capital). The altitudinal variation ranges from 800-2500 masl and is divided into three major agro-ecological zones locally identified as Dega, Woynadega and Kola i.e. 7% Dega, 45% Woynadega and 48% Kola that is comparable to say Highland, Midland and Lowland respectively. According to meteorological data the woreda receives high rainfall with an average of 145.96 mm per year. This would help keeping soil moisture for long period and providing suitability for an essentially continuous growing period for 330-360 days. Its annual average temperature ranges from 12.4^{o}c –26.8 ^{o}c. The woreda poses huge livestock resource, and according the report of CCACLP (2000) there were 79.064 cattle, 48.750 sheep, 17.159 goat, 3.037 horses, 1.605 mules, 125.714 poultry and 25.317 bee hives of local type.

STUDY DESIGN

Sample Size Determination and Sampling Methods

The epidemiological study of ixodid ticks was carried out in Kaffa zone involving a single woreda, three kebeles/PAs, and various villages/Gots. In Ethiopia, Woredas are made up of kebeles and kebeles are made up of villages. The later comprises various households (HH) as well wherefrom individual cattle were sampled. Given the prevailing ecto-parasite challenges and suitable environmental conditions and other factors the woreda has been purposively selected to conduct the study. Whereas, kebeles, villages and animals were selected randomly from each corresponding geographical zone i.e. highland, midland and lowland using a combination of sampling techniques involving Multistage, Stratified and Systematic methods. The Cattle were randomly selected at vaccination site when they came for vaccination campaign. These were basically indigenous cattle breed of *Bos indicus* managed under extensive production system. The classification of PAs into different geographical zones i.e. highland, midland and lowland was made following the description of Sjoholm (1989).

Sample Size

The sample size to determine or estimate the level of cattle ticks occurrence was calculated considering an estimated prevalence of tick infestation of 88.2% indicated by Bekele (1987), 95% CI and 5% desired error. Sample size was determined using the formula indicated by (Pfeiffer, 2002), to determine or estimate the level of disease occurrence.

Formula used to calculate sample size to estimate or detect disease occurrence:

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

n - Required sample size

Pexp - Expected prevalence

d - Desired absolute precision

Accordingly, a minimum of 153 cattle have to be sampled and for convenience the number was increased to 160 by adding 7 cattle. Thus, a total of 160 animals were sampled from each geographical zone for cross-sectional study. To ease identification of the animals, their owners were recorded and the animals were identified by their color, sex and nylon strings were tied up tightly on their neck. They were not treated with any acaricide during the study period.

Study Type

Observational Study (Cross-Sectional Study)

Estimation of prevalence of ticks was made on 160 animals selected randomly from each geographical zone. Data such as the age and body condition of the animals was recorded prior to tick collection. The age of animals was determined following the description by FAO (1983) for zebu cattle where cattle without pair permanent incisor are estimated to be under two year, with the first pair of permanent incisor are estimated to be two year and three month old, with the second pair of permanent incisor are estimated to be three year old, with the third pair of permanent incisor are estimated to be three year and six month old and with the fourth pair of permanent incisor are estimated to be four year old. Old animals more than four years have 4 pairs of permanent incisor in wear.

The body condition of study animals was measured by visual inspection and palpation of the loin area and tail head of the animal. The degree of fatness over these areas is assessed, and a score of poor and good was given. The method of scoring is adapted from that described by Radostits and Blood (1985) by modifying the degree of fatness scored from 0 to 1 as POOR and degree of fatness scored from 2 to 4 as GOOD.

Follow Up Seasonal Study

A total of 120 cattle randomly selected from the three agro-ecological zones (40 cattle from each) were subjected to different study procedures such as determination of type and burden of tick species at different seasons of the year based on their age groups and body conditions.

Study Methodology

Tick Collection

Initially, half body tick collection was made on September from 160 randomly selected animals from each agro-ecological zone for the determination of prevalence and later on following identification of the entire randomly selected animals by using nylon strings, removal of feeding ticks from the animals was carried out at four different times (early and late rainy season i.e. March to April and September to October, early and late dry season i.e. November to December and January to February). Accordingly the first round sample was collected on September 2004 representing late rainy season (LRS), the second was sampled on November 2004 representing early dry season (EDS), the third round sample was taken in January 2005 which represent the late dry season (LDS) and finally, the fourth round sample was collected on March 2005, representing early rainy season (ERS). After casting the animals down, half body tick collection was made on alternate body sides involving all visible attached adults, nymphs, and larvae of all tick species from eight (8) body regions (ear, head, dewlap, back, abdomen, udder/scrotum, ano-vulval and feet) as described by Kaiser *et al*. (1982). Tick samples from the individual animal were preserved in pre-labeled screw cap universal bottle containing 70% ethyl alcohol. Following counting and recording, the ticks were pooled into one bottle by body sites. Identification took place approximately within 10 days after collection has terminated using stereomicroscope and a guide for identification of African tick species (Hoogstraal, 1956 and Walker *et al.,* 2003) at Mizan regional laboratory (Bench Maji zone).

DATA ANALYSIS

The number and kind of data required to determine analysis include those obtained from the ticks distribution, seasonal dynamics and burden. Microsoft Excel was used for data entry and management. Descriptive statistics such as percentage, standard deviation, mean, confidence interval (CI) were used to summarize the proportion of infested and non-infested animals. The effect of different epidemiological risk factors on prevalence of ticks was analyzed with logistic regression by entering all variables at ones. Analysis of variance (ANOVA) was used to test the effect of different risk factors on mean tick burden in different groups. The statistical analysis was made using Stata 7.0 and SPSS 2002 software and the significance level was determined at $p<0.05$ for all statistical tests.

RESULTS

A total of 4,337 adult and immature ticks were collected from 480 animals as part of a cross sectional study. The result found shows that all examined cattle from lowland were positive for tick infestation followed by animals from midland and highland areas with 100%, 92.5% and 68.12% prevalence, respectively. Though the difference is not statistically significant between animals with different body conditions, the proportion of infested animals appear to be higher in animals of poor body condition (90.91%) than those in good body condition (85.16%). A significant variation ($p<0.05$) in prevalence of tick infestation was noted between different age groups, the highest being in animals of 3 and half and 4 years old, table1.

Table1. *Proportion of infested animals in different epidemiological risk factors.*

Risk factor	No of animals examined	No of infested	Infestation rate (%)	Level of Significance
Agroecology				
Highland	160	109	68.12	P-value= 0.000 OR: 7.75
Midland	160	148	92.5	
Lowland	160	160	100	
Body condition				
Poor	143	130	90.91	P-value=0.151
Good	337	287	85.16	

Age group				
0-2 pair	128	95	74.22	P-value=0.000 OR: 2.1
3 & 4 pair	243	224	92.18	
> 4 pair	109	98	89.91	

Five tick species belonging to three genera (*Amblyomma, Boophilus and Rhipicephalus*) were identified. From the total tick count, the genus *Boophilus* represented the largest proportion (64.46%) in all altitudinal zones followed by *Amblyomma* (34.68%) and *Rhipicephalus* (0.85%). The most prevalent and abundant tick species was *B. decoloratus* (46.57 %) followed by *A. cohaerens* (22.53%) from the total count. Other tick species collected in small numbers were *A. lepidium* (1.15%), *R. praetextatus* and *R. e. evertsi* (0.14%). Immature ticks were also included in our collections representing a total amount of (28.89%) from the total count. There was no variation in genera and species type encountered in different altitudinal zones, however, significant difference was observed in terms of relative prevalence and abundance, table 2. The highest tick count was found in lowland areas (n=1869) followed by midland (n=1325) and highland (n=1143). Overall, *B. decoloratus* was mostly collected from lowland areas (55.11%) while *A. cohaerens* was predominant in midland geographical zones (30.87%).

Table2. *Relative abundance of tick species in different agro-ecological zones.*

Tick species	Study sites/ geographical zones			Overall prevalence (%)
	Highland	Midland	Lowland	
B. decoloratus	551 (48.21%)	439(33.13%)	1030 (55.11%)	2020 (46.57%)
*Boophilus spp.**	163(14.26%)	221(16.68%)	392 (20.97%)	776 (17.89%)
A. cohaerens	314(27.47%)	409(30.87%)	254 (13.59%)	977 (22.53%)
A. lepidium	0	36(2.72%)	14 (0.75%)	50 (1.15%)
*Amblyomma spp**	101(8.84%)	206(15.55%)	170 (9.09%)	477 (11%)
R. praetextatus	11(0.96%)	12(0.91%)	8(0.43%)	31 (0.71%)
R. e. evertsi	3(0.26%)	2(0.15%)	1(0.05%)	6 (0.14%)
Ttotal	1143 (26.35%)	1325 (30.55%)	1869 (43.1%)	100%

** Immature*

The highest mean tick burden was found in lowland animals (11.68 ticks), in animals with poor body condition (13.34 ticks) and in those animals having 3 and half and 4 years old, (10.55 ticks), Figures 2,3,4. This variation in mean tick burden has shown significant difference for all tested epidemiological risk factors ($p<0.05$), Annex 5. In pair wise comparisons, statistically significant difference ($p<0.05$) was obtained between animals of different body conditions. No significant difference ($p>0.05$) was noted between animals of older age groups i.e. between those of more than 4 years old and those having 3 and half and 4 years old. Similarly there was no significance between highland and midland geographical zones, Annex 6.

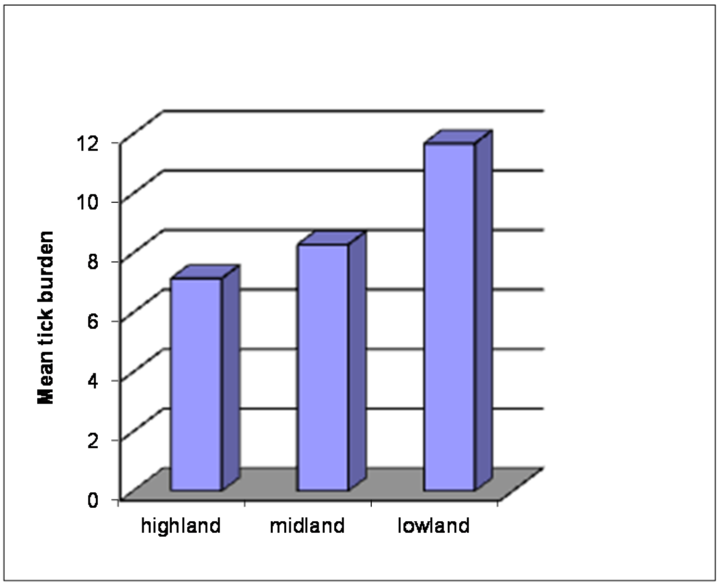

Figure2. *Mean tick burden in different geographical zones.*

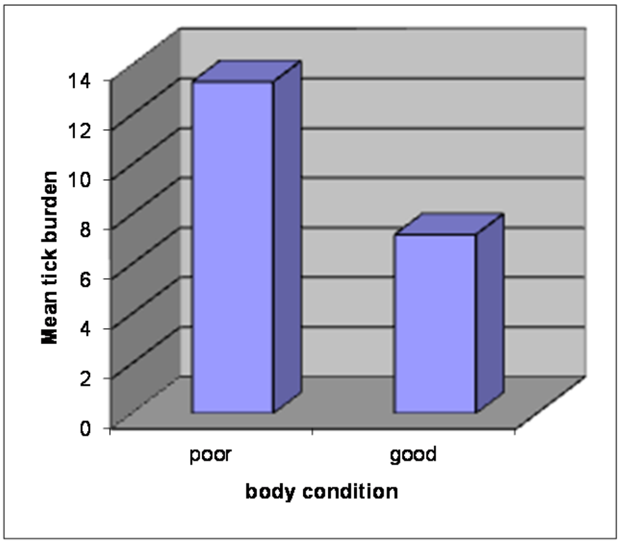

Figure3. *Mean tick burden in different body conditions.*

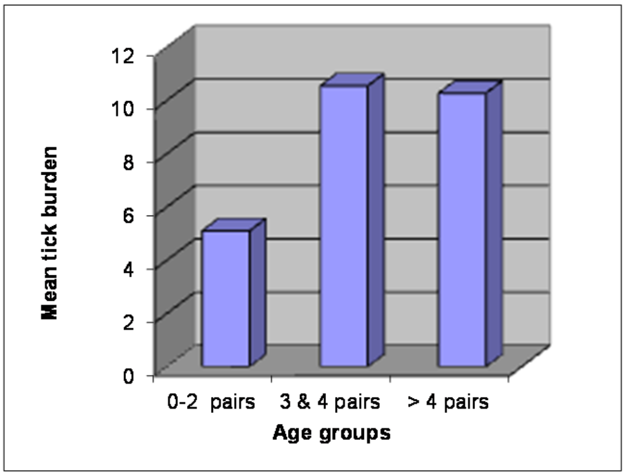

Figure4. *Mean tick burden in different age groups.*

Out of the whole collected tick population, the proportion of female adult ticks was higher than adult males; male to female ratio was greatest in species of genus *Amblyomma* and *R. e. evertsi* while for *B. decoloratus* and *R. praetextatus* females adult ticks were found to be higher, table 3.

Table3. *Sex ratio in different adult tick species.*

Species	Adult ticks		Sex ratio
	M	F	M: F
A. cohaerens	709	268	2.64:1
A. lepidium	32	18	1.78:1
B. decoloratus	597	1423	0.42:1
R. praetextatus	6	25	0.24:1
R. e. evertsi	4	2	2:1

Distribution of Ticks by Attachment Site

The distribution of tick species at eight different attachment sites as measurement of their preference is illustrated on table 4. Even though, *B. decoloratus* was virtually found all over the body, it predominates mainly on dewlap, back, belly and udder/scrotum body sites; *A. cohaerens* showed preference to the belly and udder/scrotum; *A. lepidium* has showed affinity as same as *A. cohaerens* on belly and udder/scrotum. Immature *Boophilus spp.* showed affinity mainly to dewlap, udder/scrotum and belly area while immature of *Amblyomma spp.* showed slight preference for attachment to udder/scrotum, belly and dewlap body sites. Both *Rhipicephalus spp. (R. praetextatus & R evertsi evertsi)* have shown preference for attachment to belly, udder/scrotum and ano-vulval body regions.

Table4. *Distribution of tick species on selected body sites for attachment*

Site of attachment	Tick species recovered from different geographical zones											
	n=2018	B.d (%)	n=977	A.c (%)	n=50	A. l (%)	n=35	R p (%)	n=6	R.e.e. (%)	n=477	A. spp (%)	n=774	B. spp (%)
Ear	131	6.49	16	1.64	0	-	8	5.71	0	-	43	9.01	82	10.59
Head	193	9.56	16	1.64	1	2	1	2.86	0	-	33	6.92	54	6.98
Dewlap	682	33.79	68	6.96	2	4	2	5.71	0	-	79	16.56	245	31.65
Back	373	18.48	44	4.5	1	2	1	2.86	0	-	35	7.34	91	11.76
Belly	263	13.03	328	33.57	10	20	1	2.86	1	16.67	110	23.06	124	16.02
Udder/scrotum	280	13.87	455	46.57	36	72	7	20	3	50	141	29.56	128	16.54
Ano-vulval	66	3.27	45	0.22	0	-	16	45.71	2	33.33	27	5.66	45	5.81
Feet	30	1.49	5	0.51	0	-	1	2.86	0	-	9	1.89	5	0.64

Key

B. d---- Boophilus decoloratus

A. spp—Amblyomma species (immature)

B. spp—Boophilus species (immature)

R. p---- Rhipicepalus praetextatus

R. e. e—Rhipicephalus evrtsi evertsi

A. c---- Amblyomma cohaerens

A. l---- Amblyomma lepidium

The proportion of infested animals in different seasons and other risk factors appears to be statistically non-significant (p>0.05) except for geographical zones (OR=3.03 p=0.000). However, there was some degree of variation in the proportion of infested animals within different risk factors. As shown in table 5, the highest proportion of infested animals was detected during early rainy season (98.16%), in midland geographical zone (97.37%), in animals of 3 and half years and 4 years old (94.42%) and in those of poor body condition (93.55%).

Table5. *Proportion of infested animals in different epidemiological risk factors.*

Risk factor	No of animals examined	No of infested	Infestation rate (%)	Level of Significance
Season				
Early rainy	109	107	98.16	P-value=0.892
Late rainy	120	102	85	
Early dry	120	106	88.33	
Late dry	110	106	96.36	
Geographical zones				
Highland	152	124	81.58	P-value=0.000 OR=3.03
Midland	152	148	97.37	
Lowland	155	149	96.13	
Age group				
0-2 pair	114	100	87.72	P value=0.391
3 & 4 pair	197	186	94.42	
> 4 pair	148	135	91.22	
Body condition				
Poor	186	174	93.55	P-value=0.244
Good	273	247	90.48	

Six different tick species belonging to four genera namely *Boophilus*, *Amblyomma*, *Rhipicephalus*, and *Haemaphysalis* were identified. The genus *Boophilus* was the most abundant genus (54.14%) followed by *Amblyomma* (45.1 %) and *Rhipicephalus* (0.72%) from the total count. The genus recovered with small number was *Haemaphysalis* representing (0.03%). This hierarchical status of different genera is maintained in favor of *Boophilus* in all seasons and altitudinal zones except in lowland, which is dominated by *Amblyomma* (54.03%). *Boophilus decoloratus* was the most abundant tick species found in all geographical zones and seasons accounting for 31.54% from the total count. It has been recorded in large numbers from highland altitude (33.63%) and early rain season (34.93%) i.e. March to April. *Amblyomma cohaerens* is the next abundantly collected tick species, which have got 26.09% from the total count and predominating mostly in lowland altitude (39.06%) more than that of *B. docoloratus* and in early rainy season (30.62%) i.e. March to April.

Table6. *Relative abundance of ixodid ticks in different geographical zones.*

Species	Highland	Midland	Lowland	Overall Prevalence (%)
B. decoloratus	672 (33.63%)	961 (29.73%)	404 (32.87%)	2037 (31.54%)
*Boophilus spp.**	656 (32.83%)	654 (20.23%)	150 (12.20%)	1460 (22.6%)
A. cohaerens	357 (17.87%)	848 (26.24%)	480 (39.06%)	1685 (26.09%)
Amblyomma spp.*	289 (14.46%)	674 (20.85%)	150 (12.20%)	1113 (17.23%)
A. lepidium	14 (0.70%)	67 (2.07%)	34 (2.77%)	115 (1.78%)
R. praetextatus	7 (0.35%)	24 (0.74%)	10 (0.81%)	41 (0.63%)
R. e. evertsi	3 (0.15%)	2 (0.06%)	1 (0.08%)	6 (0.09%)
H. aciculifer	0	2 (0.06%)	0	2 (0.03%)
Total	1998 (30.93%)	3232 (50.04%)	1229 (19.03%)	100%

Important figures were also obtained on immature ticks (*Boophilus spp. and Amblyomma spp.*). The highest number of the former group was recorded in highland geographical zones (32.83%) and in late rainy season (36.49%), while for the later group midland altitude (20.85%) and late dry season (21.38%). In spite of few collections made during the study period, *A. lepidium* has been recorded at the highest level in lowland altitudes (2.77%) and early dry season (3.85%). *Rhipicephalus praetextatus* and *R. e. evertsi* collectively have been found in large number in late dry season and middle altitude even though there were very few collections. Only two *H. aciculifer* tick species were found and these were recovered from midland during early and late rainy seasons.

Table7. *Relative abundance of ixodid ticks in different seasons.*

Species	Early rainy	Late rainy	Early dry	Late dry	Overall Prevalence (%)
B. decoloratus	802 (34.93%)	344 (29.6%)	500 (29.15%)	391 (30.40%)	2037 (31.54%)
*Boophilus spp.**	351 (15.29%)	424 (36.49%)	433 (25.25%)	252 (19.59%)	1460 (22.6%)
A. cohaerens	703 (30.62%)	208 (17.90%)	459 (26.76%)	315 (24.49%)	1685 (26.09%)
*Amblyomma spp.**	411 (17.90%)	176 (15.15%)	251 (14.63%)	275 (21.38%)	1113 (17.23%)
A. lepidium	21 (0.91%)	6 (0.52%)	66 3.85%)	22 (1.71%)	115 1.78%)
R.praetextatus	7 (0.30%)	3 (0.26%)	6 (0.35%)	25 (1.94%)	41 (0.63%)
R. e. evertsi	0	0	0	6 (0.47%)	6 (0.09%)
H. aciculifer	1 (0.04%)	1 (0.09%)	0	0	2 (0.03%)
Total	2296 (35.55%)	1162 (17.99%)	1715 (26.55%)	1286 (19.91%)	100%

** immature*

Result of estimates of mean tick burden for different measurable parameters indicates that except between different age groups, there is significant difference in between different geographical zones, season and body condition ($p<0.05$). The mean tick burden is significantly higher in midland altitudes (22.986 ticks), early rainy season (20.713 ticks), and in those animals with poor body condition (19.532 ticks). Pair wise comparisons on mean tick burden within different risk factors has shown results of varying degree i.e. midland compared to high and lowland zones showed significant difference ,and, no difference was observed between different age groups. The total number and relative abundance of ixodid ticks collected in different geographical zones and seasons are summarized in table 6 and 7 respectively. The highest ticks were recovered in early rainy season (n=2296) and midland altitude (n=3232)., male adult ticks were collected in large number than the females from the various geographical zones and seasons. Generally the male to female ratio appears to be (1.04:1), this ratio is consistent in species of the genus *Amblyomma* but not in *B. decoloratus* in which males of this particular species are scanty in number table 8.

Table8. *Sex ratio of adult tick species in different season.*

Species	Season	Adult ticks		Sex ratio
		M	F	M: F
A. cohaerens	Early rainy	556	146	3.81:1
A. lepidium	‘’ ‘’	11	10	1.1:1
B. decoloratus	‘’ ‘‘	184	618	0.3:1
R. praetextatus	‘’ ‘’	0	7	-
H. aciculifer	‘’ ‘’	1	0	-
A. cohaerens	Late rainy	177	32	5.5:1
A. lepidium	‘’ ‘’	3	3	1:1

B. decoloratus	‘’ ‘’	75	271	0.28:1
R. praetextatus	‘’ ‘’	0	3	-
H. aciculifer	‘’ ‘’	1	0	-
A. cohaerens	Early dry	363	96	3.78:1
A. lepidium	‘’ ‘’	55	11	5:1
B. decoloratus	‘’ ‘’	156	334	0.45:1
R. praetextatus	‘’ ‘’	2	4	0.5:1
A. cohaerens	Late dry	253	62	4.08:1
A. lepidium	‘’ ‘’	16	7	2.28:1
B. decoloratus	‘’ ‘’	121	270	0.45:1
R. praetextatus	‘’ ‘’	4	21	0.19:1

DISCUSSION

Type and Prevalence of Tick Species

A cross-sectional study conducted disclosed the high prevalence of tick infestation in the study area particularly in lowlands and midlands and the comparatively low prevalence of tick infestation in highland geographical zones. Almost all in lowland and sometimes in midlands, 100% of the animals harbor at least one or more tick species. A similar high prevalence of tick infestation has been reported in cattle of Ethiopia by (Mohamed, 1985; Bekele, 1987 and Tedla, 1991). The increased prevalence obtained in lowland as well as in midland cattle is probably attributed to the existing favorable microclimatic conditions induced by the intermittent rainfall that these areas have received during the study period combined with relatively higher temperature, which is suitable for tick development. Three genera and five tick species which include *B. decoloratus*, *A. cohaerens*, *A. lepidium*, *R. praetextatus* and *R. e. evertsi* were found during cross-sectional study. Different researchers, particularly those who have worked in the Southwest part of the country reported that these are common and abundant tick species of cattle in the area; Seleshi *et al.* (1992) and De Castro (1994) from Southwestern zones; Kassaye (1994) & Yitbarek (2004) from Jimma; Teshome *et al.* (1995) and Seid (2004) from Mizan Teferi.

In the present study, *B. decoloratus* was the most predominant tick species accounting for 46.57% from the total count. It has often been found evenly distributed in all geographical zones and almost with the same pattern in different seasons; however it is mainly recorded in low and highland zones and in early rainy season i.e. March to April. Teshome *et al.* (1995) achieved comparable results where *Boophilus decoloratus* was abundantly found at Holeta with a share of more than 80% of the count, according to them *B. decoloratus* has dominated the tick fauna picture throughout the year. The widespread distribution and high prevalence of this tick species has also been reported by various researchers (Bekele, 1987; Manueri and Tilahun, 1991; Kassaye, 1994; Behailu, 2004; Yitbarek, 2004). In early studies, Hoogstraal (1956) described the wide distribution of *B. decoloratus* throughout most of the Ethiopian faunal region currently known as Afrotropical zoogeographical region, within its range it occurs everywhere except in more open dry areas and in tropical forests. Again Morel (1980) ratified that this species is Ethiopian proper and its distribution only concerns tropical Africa. Because of its parasitic importance it has been quoted on cattle in many instances. He added that it might naturally infest wild ungulates on parts of its distributional area, mainly ruminants less commonly carnivorous mammals. Concerning to immature of *Boophilus* ticks our finding reveals that they were predominating in number as compared to *Amblyomma* in the study type accounting for an overall prevalence of 53.80%. These were widely distributed in all study sites with peak number in highland (32.83%) and in late rainy season i.e. September to October (36.49%), the low count on the other hand was observed in lowland (12.20%) and early rain season i.e. March to April (15.29%). In contrast to this, Yitbarek (2004) has found immature *Amblyomma* ticks in high quantity (72.9%) followed by *Boophilus* (24%) and *Rhipicephalus* (3.1%) out of 1215 immature ticks.This could probable be attributed to variation in the area and season of the study.

With regard to the prevalence of *A. cohaerens*, which is the second common tick species was found predominating in midland areas during the cross sectional study (30.87%) while in the longitudinal study it was recovered in great number from lowland areas (39.06%) in early rain season (30.62%) i.e. March to April. Similarly, Zelalem (2003) also recorded this tick species to be the second common tick species at Ghibe ILRI/ EARO research station next to *B. decoloratus*. Tedla (1991) in his study has found this species at higher proportion in highlands than lowland areas. Other researchers have collected it in small number and in specific places (Manueri and Tilahun 1991; Teshome *et al.*, 1995). Bekele (1987) in his study at Illubabor found *A. cohaerens* as a predominant tick species in highland and midland geographical zones. According to Morel (1980) this species is a specific parasite of the Buffalo in African savanna. It looks more particularly connected with *Syncerus caffer aequinoctialis subspecies*, but it subsists normally in cattle where there is no initial host or when it has disappeared. In Ethiopia, its collection coincides as the whole with dense formation of mountain subtropical grassland (Morel, 1980).

In the present study, the highest number of *A. lepidium* was recovered from lowland altitudes (2.77%) and in early dry season (3.85%). According to Manueri and Tilahun (1991), *Amblyomma lepidium* was found numerically less in highland collection sites; highest numbers was found in lowland areas (Shinille). Seid (2004) collected in area with an altitude in between 1100 m to 1270 masl that corroborate our findings. Similarly, Hoogstraal (1956), Seleshi *et al.* (1992) and De Castro (1994) reported this species as common and abundant in lowland areas. Yitbarek (2004) has found immature *Amblyomma* ticks in high quantity (72.9%) followed by *Boophilus* (24%) and *Rhipicephalus* (3.1%) out of 1215 immature ticks.

Effect of Season on Tick Burden and Prevalence

Though statistical variations were not observed in the proportion of infested animals of the present study, greater numbers of infested animals 98.16% and 35.54% of the whole tick count were found in early rain season i.e. March to April. According to Abebaw (2004) high humidity and temperature are crucial factors that influence the seasonal variation of ticks. Solomon *et al.* (2003) mentioned that the prevalence rate and intensity of infestation were generally low during the dry season and higher in rainy season. The absence of statistical significance obtained in our study might be attributed partly to the continuous rainfall pattern that the region has received during the study period, which enables the tick population to proliferate and maintain their reproductive capability every time.

The cycle of seasons determines the alternation of appearance, reduction, and disappearance of ticks thus; at the end of rainy season there is a marked decrease with a progressive fall to almost zero in dry season (Morel, 1989). Although different species have different microclimate requirement, as a general rule tick activity is adjusted so that tick reproduction is greatest during the rain season. Hunter (1994) describes the importance of rainfall as limiting factor in tropical and subtropical climates where temperature is suitable for tick activity. Dry environmental conditions are a serious danger to ticks particularly to the questing larvae, which are very susceptible to drying out fatally (Walker *et al.*, 2003).

In our collection, the highest number of *B. decoloratus* was recovered in early rainy season representing 34.93%. Etsay (1985) found a rise in the number of *Boophilus* that coincides with the increment in the pattern of rainfall. Morel (1989) based on the effect of environment states that parasitism is reduced during the dry months (March-June north of the equator) and increases sharply within days following the first major winter rainfall. Dreyer *et al.* (1998) also foud significantly higher numbers of *B. decoloratus* in autumn and winter (March to May and June to August) compared to spring and summer (September to November and December to March) with 76.8% of the total tick burden occurring during the cooler months. De Castro (1994) observed that in localities with rain most of the year; *B. decoloratus* females were abundant from September to April end of rainfall peak to beginning of the next rain season. In the present study, females of *B. decoloratus* were found in great number as compared to males in all study sites and seasons with a significant increment in proportion during the early rainy season i.e. March to April, a finding that concord with the findings of De Castro (1994). This result is also in agreement with the findings reported by Manueri and Tilahun (1991); Solomon *et al.* (2003); Yitbarek (2004) and Seid (2004). This might have resulted probably because of the small size of male *B. decoloratus* that can be overlooked during counting and identification. The seasonal occurrence of immature ticks was also considered where in study conducted by Seid (2004) higher count of immature *Boophilus* was recovered in December (28.31%) and a low count was recorded in March (20.19%). De Castro (1994) reported that nymphs of *B. decoloratus* were collected during March to April and October to November beginning and end of the rain respectively. In the present study highest count of immature ticks was made during early rainy season 52.83% from the total count. Nevertheless, the highest record for immature of *Boophilus* was made in late rainy season (36.49%) i.e. September to October.

Amblyomma cohaerens was found mostly during early rain (30.62%) and early dry seasons (26.76%) i.e. March to April and November to December, respectively but this numerical variation however was not statistically significant in between different seasons. In a survey conducted by Behailu (2004) this species was relatively common during collections around December (A period that coincide immediately after rainy season). They were absent from collections around February and early March. *A. lepidium* was the least recovered tick in all study sites. The highest number was recovered in early dry season (3.85%) i.e. November to December during longitudinal study. Morel (1980) considers this species as less abundant but common overlapping with *A. gemma* in the driest and with *A. variegatum* in the wettest habitats. In our study immature of *Amblyomma* ticks were likely found during the dry season (21.38%) i.e. January to February. Seid (2004) has found higher proportion of immature *Amblyomma* ticks in November (41, 94%) and lower proportion was seen in February (22.81%). According to his study, the proportion of immature *Amblyomma* was reduced as the season relatively changes from wetter to drier.

Effect of Body Condition and Age on Tick Prevalence

In both study types although no statistical significance was found in different body conditions (P>0.05), highest prevalence of tick infestation was observed in animals with poor body condition and in those animals of 3 year & six month and more than 4 years old. Seid (2004) found that tick burden on cattle in poor body condition was higher (an average of 22.49 tick per animal) than cattle in good body condition (an average of 17.76 ticks per animal). In contrast to this finding, Tesfanesh (1993) stated that age, sex, and breed differences of the host did not affect or influence the burden and species of ticks, she however explains that cattle in the adult age and having poor body condition were seen infested with large number of ticks. Onen *et al.* (1999) confirmed that generally more ticks were observed on cows than calves, very low tick counts were observed on calves aged 0-6 months than the other age groups. Seyoum (2001) found that the number of ticks attached to animals increases with their age. The difference on tick burden in different age groups may be associated to grazing practices since in almost all part of the country young animals do not go to pasture for grazing so they become less infested than the older ones.

Calves are less attractive to ticks than cows because they are protected by some form of innate, age related resistance, since host seeking activity involves awaiting hosts in an environment in advantageous positions on vegetation, they have greater chances of attaching on cows than calves because of body surface area (Onen *et al.*, 1999). It is also possible that these differences may be attributed to continuous selective grooming of calves' heads, ears, and necks by their respective dams (Fivas and De Waal, 1993). In the case of animals with poor body condition the situation might be associated to managemental and nutritional condition. For example, general malnutrition can cause reduce disease resistance by altering immune responses and a depressed immune system, in turn causes increase susceptibility to disease, reduce immunological response to vaccines, and non responsive to medical therapy (Radostits, 2001).

CONCLUTIONS AND RECOMMENDATIONS

The present study demonstrated that highest proportion of animals were infested in lowland and midland areas where there is suitable environmental conditions for tick alternation of and high tick burden was found during the early rainy season i.e. March to April indicating the direct role of rainfall in the distribution and population density of ticks. It was apparent that large number and different species of ticks were collected, and a remarkable number of cattle found to be infested with ticks in all agro-ecological zones.

On the other hand, ticks are important not only because of disease transmission but also they are excellent blood feeders leading to anemia, cause mechanical or cytolitic effect, they are responsible also for different conditions associated with toxins they produce etc. The current attempt by the government to improve the blood levels of the local animals through artificial insemination and distribution of improved cattle breeds to farmers should take into consideration the widespread existence of tick in the area, and the susceptibility of exotic or crossbred animals to tick and tick-borne diseases. Further, the unrestricted movement of cattle from place to place coupled with the closeness and climatic similarities of the study area to countries like Kenya and Sudan with potential disease entities makes the area as well as the country in a situation continuously threatened by different tick

Based on the present finding the following recommendations are made:

- Application of acaricides particularly during early rainy seasons inducing the tick population to manageable level i.e. to the extent without affecting the enzootic stability.
- Restriction of movement of cattle and quarantine measures especially from marginal or bordering areas into the country should be exercised.
- Creation of awareness among livestock owners on the potential effect of tick and tick-borne diseases and on means of improving the traditional management system in general and the nutritional status of their animals in particular should be made.
- A more detailed and year round epidemiological study and a constant surveillance of tick required using more sensitive diagnostic techniques

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