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Full Length Research Paper

Study on prevalence and identification of ixodid ticks in cattle in Gursum district, East Hararghe Zone of Oromia Regional State, Ethiopia

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The current study on prevalence and identification of ixodid ticks in cattle was carried out in Gursum district, East Hararghe Zone of Oromia regional state, from November 2015 to April 2016. A total of 1447 ticks were collected from nine body parts of 384 cattle kept under extensive management system. Out of 384 cattle examined, 232 were found harbor one or more tick species. The identified tick species were *Amblyomma variegatum*, *Rhipicephalus evertsi, Rhipicephalus* (*Boophilus*) *decoloratus, Rhipicephalus pulchellus, Hyalomma marginatum* and *Amblyomma gemma*. The risk factors such as sex and age of animals, seasonal and agro ecological variation of tick infestation, predilection sites and male to female ratio of ticks were considered in this study. Among the risk factors considered, gender and age of animals did not show significant difference but predilection sites, seasonal and agro-ecological variation of tick infestation showed significant difference. Tick infestation was higher in wet season than in dry season. This study also indicated higher prevalence of ticks in mid-altitude and lowland areas than in highland areas. As to attachment sites, *A. variegatum* had preference for axillae, udder or scrotum; *R. evertsi* for base of tail and anus; *B. decoloratus* for different body parts; *R. pulchellus* for ear, tail, anus and scrotum/udder and *H. marginatum* for tail and ano-vulval areas. In case of male to female ratio, all the tick species had higher number of males than females except *B. decoloratus* which had higher number of females than males. With the occurrence of such degree of tick infestation in the area, the economic impact of ticks and tick-borne diseases in Gursum district and the country as a whole should be given a high priority in devising effective and sustainable control strategies of ticks.

Key words: Age, agro-ecology, Gursum, prevalence ratio, season, sex, species.

INTRODUCTION

Infestation of domestic animals by external parasites is one of the major challenges in the process of delivering effective animal healthcare services in Ethiopia (Bekele, 2002). Ticks are among economically important

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ectoparasites losses to the livestock keepers and to the country as a whole through reduction of products and productivity of animals, serving as vectors of disease, damaging hide and skins and consequently resulting in rejection of hide and skins at industrial level (Bekele, 2002).

Besides being important vectors of animal diseases such as theileriosis, anaplasmosis, babesiosis and cowdriosis, ticks also cause nonspecific symptoms like anemia, dermatitis, toxicosis, and paralysis in animals (Gebre et al., 2007). Ticks are obligate blood feeding ectoparasites (Rajput et al., 2006). They occur worldwide in distribution, but principally occur in tropical and subtropical regions with warm and humid climate which are suitable to undergo metamorphosis (Kilpatrick et al., 2007).

In Ethiopia, there are 47 species of ticks affecting the livestock and most of them have importance as vectors of disease causing agents in addition to their damaging effects on hide and skins (Kassa, 2005). Even though a number of researchers have reported the distribution and abundance of different tick species in different parts of Ethiopia, no study has been carried out in and around Gursum district to determine the prevalence and type of tick species affecting cattle in the area. Therefore, the current study is conducted to identify the prevalence and type of tick species of cattle in the study area in order to plan effective and relevant control strategies on ticks and tick borne diseases.

METHODOLOGY

Study area

The study was conducted in Gursum district in East Hararghe zone of Oromia Regional State from November 2015 to April 2016. The district capital, Funyan bira town, is located at 600 km East of Addis Ababa, the capital city of Ethiopia. Geographically, the district lies between 9° 07' and 9° 32' North latitudes and 42° 17' and 42° 38´E longitudes. The total area coverage of the district is estimated at 76 to 261 hectares of land. The altitude of the district ranges from 1200 to 2938 m above sea level with the annual rain fall of 650 to 750 mm and the mean annual minimum and maximum temperature of 18 and 25°C, respectively. Gursum is bordered in the east by Somali regional state, in the west by Harari regional state, in the north by Jarso district and in the south by Babile district. It is inhabited by a human population of about 168476 people (CSA, 2013). The district is divided into 3 agro-ecological zones: highland (5%), midland (45%), and lowland (50%). The area has short rainy season (March to April) and long rainy season (June to August) According to GLFDO (2015).

Study population

The livestock population in the study area is estimated to be 116699 cattle, 73331 goats, 33474 sheep, 8735 camels, 18012 donkeys, 52881 chickens and 6625 beehives (2016). A total of sample population of 384 heads of cattle was examined out of the source population of 116699 heads of cattle in the district to determine the prevalence and species of ticks in the area. All the cattle sampled were local breeds kept under extensive production system.

Study design

A cross-sectional type of study method was used to determine the prevalence and species of ticks in the area, their predilection sites on the animals, tick burden among different age groups and sexes, and seasonal and agro-ecological variation of tick infestation. The ages of animals were grouped into young (1 to 2 years), adult (3 to 7 years), and old (>8 years) according to Gaten (1991).

Sample size determination

Since there was no previous study conducted on ticks in cattle in the area, sample size was determined by assuming 50% prevalence of tick infestation in the area. The desired sample size for the study was calculated by the formula given by Thrusfield (2007). Therefore, if 95% confidence interval is required with 5% margin of error, the sample size (n) is determined by the formula:

$n= z^2 p (1-p) / w^2$

where n = sample size, p = prevalence, W = margin of error and z is a constant from normal distribution table.
Accordingly, the sample size (n) in this case was determined as follows:

$n = (1.96)^2 \times 0.5(1-0.5) / (0.05)^2 = 384.$

Therefore, sample size of 384 cattle was examined in the study.

Collection of ticks

The whole body surface of the animals were examined for the presence or absence of ticks and half body tick collection methods on the alternate sides were used to collect ticks from the animals and the result doubled to assess the overall burden of ticks (Keiser, 1987; Walker et al., 2003). Ticks were collected from different body sites such as ear, neck, axillae, leg, tail, anus, vulva, udder, scrotum and the belly after proper physical restraining of the animals. During collection, ticks were removed manually from different attachment sites of the animal body by a rotating manner to retain their body parts for identification (Wall and Shearer, 2001).

Data collection format was used to register the data during tick collection and proper labeling was made on universal bottles with permanent marker. Date of collection, address, species, sex, age, code of animal and sites of attachment were included in the labeling. Ticks collected from different body sites were preserved in different universal bottles, prefilled with 70% ethanol, for each animal. Then, transported to Hirna Regional Veterinary Laboratory for further identification of the ticks at genera and species level.

Identification of ticks

Stereomicroscope was used to identify the ticks based on their morphological features such as mouthparts, scutum, color of legs, festoons, interstitial punctations, presence or absence of adanal shields, posterior groove and marginal spots. The taxonomic keys of Hoogstraal (1956), Walker (1974), Kaiser (1987) and Walker et al. (2003) were used to identify the ticks under stereomicroscope by manipulating each tick with wire loop.

Table 1. Overall prevalence of tick infestation.

Sex	Total Number of animals examined	Positive	Negative
Male	170	105 (61.8%)	65 (38.2%)
Female	214	127 (59.3%)	87 (40.7%)
Total	384	60.41667	152 (39.583)

Table 2. Number and species of ticks collected in relation to attachment sites on the host

Site of attachments	Type of tick species collected					
	R. pulchellus	*R. evertsi*	*H. marginatum*	*B. decoloratus*	*A. variegatum*	*A. gemma*
Ear	25	1	-	-	-	-
Neck	-	-	-	52	7	-
Tail	20	103	40	-	-	-
Anus	16	83	13	-	-	-
Vulva	2	10	5	-	-	-
Axillae	2	2	3	37	355	2
Leg	-	-	2	18	5	0
Scrotum/Udder	22	3	5	41	563	8
Belly	-	-	-	2	-	0
Total	87	202	68	150	930	10

Data analysis

All the data recorded in this study was first entered into Microsoft excel and later analyzed by using SPSS software. Descriptive statistics was also used to analyze predilection sites of ticks on the animals. Chi-square test was used to determine the variation in tick burden among different age groups, sexes, agro-ecological zones, and seasons. 95% Confidence interval and 5% precision level was set for significance level.

RESULTS

A total of 384 cattle were examined out of which 170 (44.2%) were males and 214 (55.73%) were females (Table 1). 232 cattle (60.4%) were positive for one or more tick species. A total of 1447 ticks were collected which included *Amblyomma variegatum* 64.27% (930), *Rhipicephalus eversti* 13.96% (202), *Boophilus decoloratus* 10.37% (150), *Rhipicephalus pulchellus* 6.01% (87), *Hyalomma marginatum* 4.7% (68) and *Amblyomma gemma* 0.69% (10).

A. variegatum was recorded as the most prevalent tick species in the current study area followed by *R. eversti, B. decoloratus*, *R. pulchellus, H. marginatum* and A*. gemma* in descending order. Accordingly, A*. gemma* was found to be the least prevalent species out of the ticks identified (Table 3).

In this study, there was no statistically significant difference (χ^2=0.23, P>0.05) in prevalence of tick infestation between male and female animals (Table 1).

It was revealed in this study that different tick species have different predilection sites (Table 2). According to this result, *A. variegatum* had strong preference for axillae, udder or scrotum, *R. eversti* for base of tail and anus, *B. decoloratus* more or less for different body parts, *R. pulchellus* for ear, tail, anus and scrotum/udder, and *H. marginatum* for base of tail and ano-vulval areas.

At species level, the male to female ratio of ticks was *A. variegatum* (2.5:1), *R. eversti* (2:1), *B. decoloratus* (0.5:1), *H. marginatum* (2:1), and that of *R. pulchellus* was recorded as 1.4:1. The male to female ratio of *A. gemma* was not possible to figure-out, because there were no any female ticks identified in the counting. The result indicated that there were more males than females in all the ticks except in *B. decoloratus* which had more females than males.

Based on seasonal variation of tick infestation, the result indicated that there was statistically significant variation (χ^2=9.9, P<0.05) between dry and wet seasons of the year. In dry season, prevalence of tick infestation was 50.3%; but the prevalence in wet season was higher which was recorded as 66.5% (Table 4).

In relation to agro-climatic distribution of ticks, the result of this study showed that there was high prevalence of ticks in the mid-altitude, 67.3% (152) and the lowland areas, 68.4% (54) compared to less prevalence of 32.9% (26) in highland areas. According to this analysis, there was statistically significant variation (χ^2=34.5, P<0.05) among the three agro-ecological zones with the least prevalence recorded in highland areas (Table 5).

In terms of tick infestation in association with age

Table 3. Overall prevalence of tick species and male to female ratio.

Tick species	No. of ticks collected				
	Male	Female	total	Prevalence (%)	Male to female ratio
Rhipicephalus pulchellus	51	36	87	6.01	1.4:1
Rhipicephalus evertsi	134	68	202	13.96	2:1
Boophilus decoloratus	50	100	150	10.37	0.5:1
Hyalomma marginatum	46	22	68	4.7	2:1
Amblyomma variegatum	665	265	930	64.27	2.5:1
Amblyomma gemma	10	-	10	0.69	-
Total	956	491	1447	-	2:1

Table 4. Seasonal variation of tick infestation.

Season	Total number of animals examined	Positive (%)	Negative (%)
Dry	145	73 (50.3)	72 (49.7)
Wet	239	159 (66.5)	80 (33.5)
Total	384	232 (60.4)	152 (39.6)

Table 5. Agro ecological variation of tick infestation.

Agro-ecology	Total animal examined	Positive (%)	Negative (%)
Highland	79	26 (32.9)	53 (67.1)
Mid altitude	226	152 (67.3)	74 (32.7)
Lowland	79	54 (68.4)	25 (31.6)

Table 6. Prevalence of tick infestation in relation to age group of animals.

Age	Total animal examined	Positive (%)	Negative (%)
Young	142	78 (54.9)	64 (45.1)
Adult	220	141 (64.1)	79 (35.9)
Old	22	13 (59.1)	9 (40.9)

groups of animals (young, adult and old categories), the result indicated that there was no statistically significant difference (Table 6). The results recorded were that 54.9% (78) in the young, 64.1% (141) in the adult and 59.1% (13) in the old animals.

DISCUSSION

Different tick species are widely distributed in Ethiopia and a number of researchers reported the distribution and abundance of tick species in different parts of the country (Solomon et al., 2001; Goshu et al., 2007). In the current study, the overall prevalence of tick infestation was found to be 60.4%. This finding is in line with the reports of Tadesse and Sultan (2004) with overall prevalence of 59.5%. However, the results of this study is lower than reports of Alemu et al. (2014) and Gedlu et al. (2014) who reported the overall prevalence of 81.5 and 74%, respectively. On the other hand, various research works have found less prevalence of tick infestation than the current study including the reports of Addis (2011) and Onu and Shiferaw (2013) who indicated tick prevalence of 25.64 and 14.5%, respectively.

At species level, *A. variegatum* was the most abundant tick species with prevalence of 64.27%. The result of this study was greater than the previous works of different researchers including Onu and Shiferaw (2013), Abebe et al. (2010), Tadesse and Sultan (2014), and Bedaso et al.

(2014) with prevalence of 4.75, 4.2, 32.2, and 41%, respectively. But this result is lower than the result of Messele (1989) in Bahir Dar with prevalence of 75.91%. The difference could be due to the difference in the agro-climatic condition of the study areas, because tick activity is influenced by rainfall, altitude and atmospheric relative humidity according to Pegram et al. (1981).

A. variegatum is the most widely distributed cattle tick in Ethiopia (Morel, 1980; Pegram et al., 1981) and has a great economic importance, because it is an efficient vector of *Cowdria ruminantum*, the causative agent of cowdriosis or heart-water in cattle (Morel, 1980). *A. variegatum* also causes the greatest damage to hides and skin because of its long mouthparts which downgrades the value of these products on world market if infestation is high (Solomon et al., 2001). Furthermore, trauma caused by tick-bite becomes favorable site for secondary bacterial infection.

R. evertsi was the second abundant tick species according to this study with prevalence of 13.96%. This result is in agreement with the previous work reported by Tamerat et al. (2015) and Alemu et al. (2014) with prevalence of 13.5 and 11.5%, respectively, but it is lower than the results of Abdisa (2012) and Huruma et al. (2015) who reported 50.9 and 53.4%, respectively.

B. decoloratus was the third abundant tick species in the area with prevalence of 10.37%. This result is slightly in agreement with the report of Tamiru et al. (2010) who indicated 15.4% prevalence. But this result is in disagreement with the report of Bossena and Abdu (2012) who reported higher prevalence in Assosa region. This difference might be due to *B. decoloratus* being abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually according to Pegram et al. (1981).

R. pulchellus was the fourth abundant tick in this study with prevalence of 6.01%. The result in this study is in agreement with the results of Wallaga (1997) who reported infestation of 6.97% in and around Debre Zeit.

H. marginatum was the fifth tick species reported in this study with prevalence of 4.7%. This result is also in agreement with the result of Kalil (2010) who reported prevalence of 5.05% in Goba and Robe districts of Bale zone. But the result of this study disagrees with the report of Meaza et al. (2014) who reported 33.13% prevalence in Bahir Dar which is much higher than our current result. On the other hand, the result of this study is higher than the reports of Hussen (2009) in Bako, Tamiru (2008) in Assela, and Tiki and Addis (2011) in and around Holeta who reported 1.2, 2.5 and 1.86%, respectively. The low prevalence of this tick species could be due to altitude difference between study areas as stated by Pegram et al. (1981).

A. gemma was the least abundant tick species identified in the area (0.69%). This result is in line with the previous result of Yitbarek (2004) who reported infestation of a single animal with 12 ticks of *A. gemma* in Jimma areas similar to our current study which indicated 0.69% out of the total tick counts.

In the current study, the difference in prevalence of ticks was found to be statistically insignificant (X^2=0.23, P>0.05) between sexes of cattle. This result is in agreement with the results of Tesfaheywet and Simeon (2013) but disagrees with the previous works in Assosa by Bossena and Abdu (2012) who reported statistically significant difference between sex groups.

In association with age groups of animals, there was no difference in infestation level among age groups according to the current study. This result is actually in agreement with the reports of Tamiru et al. (2010) and the reports of Kalil (2010) who reported that the effect of age on the burden of ticks was not significant but disagrees with other reports by Gurmesa et al. (2015) who reported high degree of variation in tick infestation among age group of animals indicating that adult animals are more affected than young animals.

The number of male ticks was higher than the number of females in all tick species except *B. decoloratus* in which the number of females was higher than the number of male ticks. This finding agrees with the reports of Abdisa (2012) and Badaso et al. (2014) who reported similar results. This high number of male ticks may be attributed to the fact that fully engorged female tick drops off the host to lay eggs while males tend to remain on the host up to several months to continue feeding and mating with other females on the host before dropping (Solomon et al., 2001). The reason that female *B. decoloratus* outnumber the males could be due to the small size of males which may not be seen during collection (Tessema and Gashaw, 2010).

In this study, there was significant difference (χ^2=34.5, P<0.05) in prevalence of tick infestation among the agro ecologies where significantly higher prevalence was recorded in mid-altitude and lowland areas (67.3 and 68.4%, respectively) compared to the situation in highland areas where 32.9% prevalence was recorded. This study result is in agreement with the work of Tedla (1991) who indicated that there was difference in infestation rate in different climatic zones showing high prevalence in lowland and mid-altitude areas compared to less prevalence in highland areas.

There was statistically significant difference (χ^2=9.9, p<0.05) in seasonal infestation of ticks between dry and wet seasons of the year in the current study. According to the current result, infestation was higher in wet season, especially after the onset of short rainy season, than in dry season of the year. This result is very much in agreement with the previous results of Tedla (1991) who reported seasonal variation of tick prevalence indicating that the number of ticks on livestock decreases in dry season and increases after the short rainy season in eastern Hararghe region.

In relation to the attachment sites of ticks on the host body, different tick species were found to be having

different predilection sites in this study. Accordingly, *A. variegatum* had strong preference for axillae, udder or scrotum; *R. evertsi* for base of tail and anus; *B. decoloratus* more or less for different body parts; *R. pulchellus* for ear, tail, anus and scrotum/udder and *H. marginatum* for base of the tail and ano-vulval areas. The result of this study is in line with the results of Stachurski (2000) who stated that short hypostome ticks like *Rhipicephalus* usually prefer upper body parts including nape of neck and margin of anus and under tail, while long hypostome ticks like *Amblyomma* attaches to lower parts of the animal body which is also the case in the current study.

CONCLUSION AND RECOMMENDATIONS

In this study, high prevalence of *A. variegatum*, which has great economic impact due to its effects of disease transmission and physical trauma to animals, was identified along with other tick species such as *R. evertsi* and *B. decoloratus* which also have role in disease transmission and other effects on the health of animals. Even though prevalence of ticks is high in the area, proper policies and strategies are not yet in place to control external parasites including ticks. Awareness of livestock owners on the impact of ticks on their livelihoods is low. Furthermore, financial and material support from public sector to animal healthcare system is not sufficient to promote control programs on ticks.

Therefore, sustainable tick control program should be put in place in order to reduce the current trend of prevalence to lower level. In the consequence of this conclusion, the following recommendations are suggested:

(1) Awareness campaign on tick control should be promoted among livestock owners
(2) All stakeholders concerned with livestock production and healthcare programs should make concerted effort to plan and implement effective control programs on ticks and other external parasites.
(3) Sufficient budget should be allocated for the purchase of chemical sprays and spraying equipment on yearly basis.
(4) Varieties of drug choices should be used alternately in order to reduce the potential of drug resistance.
(5) Animal healthcare education should be provided to livestock owners to have know-how on how to prevent their animals from tick infestation.
(6) Environmentally friendly acaricide products and injectable drugs should be used.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Study on cattle tick species frequency distribution in and around Jimma province of Ethiopia

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The prevalence and abundance of tick species of cattle were studied in and around Jimma town of South Western Ethiopia from November, 2015 to March, 2016. The overall prevalence of tick in cattle was about 88.8%. A total of 4579 adult ticks were collected from 384 cattle. Of the total tick collected, *Amblyomma* and *Rhipicephalus* constitute 76.7 and 23.3%, respectively. Three species belonged to the genus *Amblyomma* and two species belong to *Rhipicephalus*. The species encountered were *Amlyomma cohaerens* (40.68%), *Amblyomma variegatum* (33.58%), *Rhipicephalus decoloratus* (19.98%), *Rhipicephalus evertsi eversi* (3.32%) and *Amblyomma gemma* (2.42%). The study therefore, revealed that *A. coherence* and *A. variegatum* were the most prevalent cattle tick species in and around Jimma. A statistically significant difference (p<0.05) was observed in tick burden between cattle in good body condition and those in poor body condition. That is, cattle with poor body condition had higher tick burdens than good body condition. The infestation level by age and sex were also statistically significant (p < 0.05). As the age of animals increase, tick burden also increases. Similarly, the female animals carried more ticks than males. The favorable predilection site of *Amblyomma* species were the scrotum (udder) and perineum, while *Rhipicephalus* were more around ano-vulva, udder and the tail area. Ticks are important ectoparasites in and around Jimma and cause huge economic losses to the livestock industry. Much attention has to be given to control ticks by the use of acaricides, integrated with other techniques to minimize their effect.

Key words: Ethiopia, cattle, Jimma, prevalence, ticks, burden.

INTRODUCTION

Cattle are a primary resource of earning for people of Ethiopia (CSA, 2002). However, ecto-parasites including ticks are the major contributing factors that impact health and production of cattle (Bossena and Abdu, 2012). Ticks and tick born diseases (TBDs) are widely distributed particularly in tropical and subtropical countries, responsible for tremendous loss in cattle production (Kettle, 1995; Fantahun and Mohamed 2012). In Ethiopia, ticks ranked first among ecto-parasites (Walker et al., 2003).

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The main ticks found in Ethiopia include *Amblyomma, Haemaphysalis, Hyalomma* and *Rhipicephalus*. The most important and wide spread tick species are *Amblyomma variegatum* (vector of disease, *Ehrlichia ruminantum* and *Theileria mutans*) and *Rhipicephalus decoloratus* (vector of the disease, *Anaplasma marginale* and *Babesia bigemina)* (Abebaw, 2004).

Ticks are blood feeding ectoparasites which are capable of transmitting disease-causing pathogens to their hosts if they are infected. Ticks do not only transmit diseases but also cause damage to the skin of their hosts resulting in irritation (tick worry) of hosts, lower productivity, blood loss and udder damage, while they also inject toxins into host animals. In addition, ticks carry numerous diseases that affect as much as 80% of the worlds' cattle population. Therefore, ticks can lead to significant economic losses. Economic losses attributable to ticks comprise of decreased productivity and mostly losses due to costs of controlling both tick infestation and tick-borne diseases (Bloemfontein, 2016).

In Jimma zone, cattle are always under the risk of tick infestation and tick born disease challenges. There are different methods for control of ticks infestation in the area, these includes removal of ticks and acaricides treatments. But still the challenge of tick on animals was seen in the study area, because the control methods practiced in the area had not covered wide area of the households, it is only for those cattle presented to the veterinary clinics (from general view in the area during the pilot study). Hence, this study was attempted with the objectives: To identify the main tick species infesting cattle and their distribution in and around Jimma town and to assess associated risk factors with tick infestation.

Research question

1. What is the prevalence of the ticks?
2. What are the types of ticks infesting the cattle in and around Jimma?
3. What factors are associated with tick infestation?

MATERIALS AND METHODS

Study area, population and design

The study was conducted in and around Jimma town which is about 346 km South West of Addis Ababa and located between 7° 13" to 8° 56" North latitude and 35° 52" to 37° 37" East longitude. It lies in altitudinal range of 880 to 3359 m above sea level (m.a.s.l). The average annual rainfall is 1200 mm. The weather condition is hot and humid with temperature fluctuation between 7 and 30°C. The total animal population of the Jimma zone is about 4,322,761 in 2015. Cattle population is about 3,213,548. Majority of these cattle's were kept under extensive management system which are highly prone to tick infestation (According to the Jimma city, Finance and Agriculture Office).

A cross sectional study design was conducted to identify important tick species infesting cattle in and around Jimma town of Ethiopia during November, 2015 to March, 2016. Age, sex and body condition of the animal was considered as variables on the prevalence and infestation rate of ticks. Body condition scoring (BCS) refers to the relative amount of subcutaneous body fat or energy reserve in the cow. Poor body condition in cattle is a condition of cattle that is characterized by deep cavity with no fatty tissue under skin in the area of tail head. Skin is fairly supple but coat condition is often rough and spine prominent with horizontal processes of sharp of loin. Whereas, good body condition is characterized by fat accumulation over whole area of tail head and smooth skin but pelvis can be felt and end of horizontal process can only be felt with pressure in area of loin with only slight depression in loin.

Sample size determination and sampling method

The sample size was determined by using the formula given by Thrusfield (2005) with expected prevalence of 50%, at 95% level of significance and 5% absolute precision. Accordingly, a total of 384 cattle were sampled to know which species of ticks were prevalent in the area.

The sampling techniques used were a multiple stage sampling methods. Simple random sampling was used in each stage. Jimma town has about 17 kebele. From these, 6 kebeles were selected, and then from each kebele, the households were also selected. Here, the sampling frame was the numbers of households in each kebele. Finally, each individual cattle were selected from each household.

Investigation procedure

An investigation procedure requires both field works and laboratory investigation of collected tick samples. Ticks were collected from cattle and transferred into universal sampling bottle containing 70% ethanol (Okello et al., 1999; Walker et al., 2003). During the study time, different body region of the cattle were considered for tick collection. These includes head, dewlap, brisket, belly, back, udder or scrotum, ano-genital, legs, tail, perineum, ear and hump were thoroughly assessed. Ticks were removed from the cattle skin whilst retaining their good morphological condition for identification using steel forceps after application of a drop of 70% ethanol to the site where the mouth of ticks were imbedded.

The collected ticks from each body regions were kept separately for identification in separate sample bottles containing 70% ethanol until identification was done according to Matthysse and Colbo (1987). Finally, ticks were identified, counted and recorded up to species within 5 days of collection using stereomicroscope (Hendrix, 1998).

Data analysis

Analysis of obtained data was done by Chi square (x^2), ANOVA and independent samples test were used to test the association between ticks infestation with different factors (age, sex and body condition score). For this analysis, SPSS, version 20 was used (SPSS INC. Chicago, IL).

RESULTS

The study was conducted from November, 2015 to March, 2016. The overall prevalence of tick in cattle was about 88.8%. A total of 4579 adult ticks, comprising two were

Table 1. Species and sex wise proportion of tick collected from cattle of Jimma town of Ethiopia.

Tick species	Sex of Ticks		Male to female ratio	Total	
	Male	Female		Number	Percent (%)
A. cohaerens	1231	632	1:95	1863	40.69
A. variegatum	975	563	1:73	1538	33.59
R. decoloratus	7	908	0:01	915	19.98
R.evertsi evertsi	100	52	1:92	152	3.32
A. gemma	82	29	2:83	111	2.42
Total	2395	2184	1:1	4579	100

Table 2. Prevalence of cattle tick species on the basis of body condition.

Body condition	No. of examined cattle	No. of infested cattle	Infestation rate (%)
Poor	146	135	92.50
Medium	128	118	92.18
Good	110	86	78.18

Table 3. Tick burden in relation to age, sex and body condition of the cattle.

	Age		Sex		Body condition		
	<3 year	>3 year	Male	Female	Poor	Medium	Good
No of cattle examined	173	211	190	194	146	128	110
Tick burden	1813	2752	1949	2630	1930	1588	1061
Mean tick burden/ head	10.48	13.11	10.26	13.56	13.22	12.41	9.65

genera and five species were collected from 384 cattle (Table 1). The genera of ticks encountered *Amblyomma* and *Rhipicephalus* with relative infestation rate of 76.70 and 23.3%, respectively. The five species identified were *Amblyomma cohaerens, Amblyomma variegatum, Amblyomma gemma*, *Rhipicephalus decoloratus* and *Rhipicephalus evertsi eversi*.

Frequency distribution wise, *A. cohaerens* was the top most prevalent tick species with prevalence of 40.69%, followed by *A. variegatum* with prevalence of 33.59%, *R. decoloratus* with prevalence of 19.98%, *R. evertsi evertsi* and *A. gemma* with lower prevalence of 3.32 and 2.42%. The male to female ratio recorded was 1:95 for *A. cohaerens,* 1:73 for *A. variegatum* and 0:01 for *R. decoloratus*. (Table 1).

Cattle with poor body condition had significantly higher tick burdens than those with good body condition (P=0.003, X^2=11.32) (Table 2). Age wise infestation level was statistically significant (P<0.005), the mean ticks were 10.48/head in cattle of ≤3 years and 13.11/head in cattle of >3 years), as the age of cattle upturn ticks burden also increases. Similarly, the female cattle also carried more ticks than males, significant difference (P= 0.0032) was found (Table 3).

DISCUSSION

Identifying and knowing the prevalence of the ticks is important for the control of tick burden and tick born disease. Comparing the present studies with the previous study also has a role in identifying the status of the tick infestation in the study area (Table 4).

The abundance of *A. cohaerens* in this study area was due to geographic location and humid climatic condition of South Western part of Ethiopia and also due to its being relatively active throughout the year. This result agreed with previous studies on survey of the tick species in Jimma zone, western Ethiopia conducted by Pegram et al. (1981), Abebaw (1994), De Castro (1994). They found high prevalence of *A. cohaerens* in their study. *A. variegatum* was the second most abundant tick species. It was the most widely distributed cattle tick in Ethiopia, as reported by the survey in Assosa (Bossena and Abdu, 2012) with prevalence 75.91%. *Amblyomma* ticks are vectors of cowdriosis (heart water) of cattle and small ruminents. Thirteen species *oí Amblyomma* are known to be able to transmit cowdriosis (Pawlos and Derese, 2013).

Rhipicephalus decoloratus was prevalent in many other

Table 4. Ticks species with infestation on different body parts of the cattle.

Site of attachment	*A. cohaerens*		*A. variegatum*		*R. decoloratus*		*R. evertsi eversi*		*A. gemma*		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Udder/scrotum	611	32.80	485	31.53	166	18.14	15	9.87	21	18.92	1298	28.35
Perineum	413	22.17	371	24.12	172	18.80	8	5.26	12	10.81	976	21.31
Brisket	262	14.06	244	15.86	121	13.22	-	-	11	9.91	638	13.93
Neck	155	8.32	85	5.53	163	17.92	-	-	17	15.32	421	9.19
Ano-vulva	212	11.49	123	8.00	135	14.97	57	37.50	19	17.12	550	12.01
Dewlap	143	7.68	111	7.22	113	12.35	-	-	8	7.21	375	8.19
Under tail	27	1.45	97	6.31	17	1.86	67	44.08	13	11.71	221	4.83
Abdomen	9	0.48	11	0.72	4	0.44	-	-	7	6.31	31	0.68
Back	2	0.11	-	-	2	0.22	-	-	-	-	4	0.09
Thigh	-	-	-	-	7	0.77	-	-	-	-	7	0.15
Hump	7	0.38	4	0.26	3	0.33	-	-	3	2.70	17	0.37
Head	3	0.16	-	-	4	0.44	-	-	-	-	7	0.15
Mandible	-	-	-	-	5	0.55	-	-	-	-	5	0.11
Ear	17	0.91	7	0.46	-	-	5	3.29	-	-	29	0.63
Eyelid	2	0.11	-	-	-	-	-	-	-	-	2	0.04
Foot	-	-	3	0.19	3	0.33	-	-	-	-	6	0.31
Total (%)	1863		1538		915		152		111		4579	

parts of the country such as Assosa, Bahir dar and Nekemte. The result of this study (19.98%) disagrees with finding of Alekaw (1998) at Metekel Ranch, Ethiopia showing prevalence of 5.7%. This may be due to the difference in geographical location and altitude factor. This tick species is abundant in wetter highland and sub-highlands receiving more than 800 mm rainfall annually (Pegram et al., 1981).

3.32% *Rhipicephalus evertsi evertsi* was also reported in Bahir Dar (Mesele, 1989), Jimma (Abebaw, 2005). Morel (1980) mentioned that the native distribution of *R. evertsi evertsi* in Ethiopia seems to be connected with middle highland, dry savannas and steppes in association both Zebra and ruminant. But this tick species shows no apparent preference for particular altitude, rainfall zones and seasons (Pegram et al., 1981), so appears to occupy a wide range of climatic and ecological condition. *Rhipicephalus* ticks are the main vector of bovine babesiosis and ovine ehrlichiosis. *R. evertsi-evertsi* is a possible vector of *Babesia, Rickettsia* and *Theleria* (Pawlos and Derese, 2013). The least finding of *A. gemma* (2.42%) is similar to the pervious finding (De Castro, 1994). This may be due to environmental condition which is not favorable to their survival, humid and highland nature of the area. This species of ticks is confined to semi arid lands of Harar province (Pegram et al., 1981).

The male to female sex ratio of the ticks were similar to previous reports (Solomon et al., 2001; Solomon et al., 2007; Mesele, 1989). In all cases, except *R. decoloratus,* males outnumbered females. This is due to fully engorged female ticks drop off on the ground to lay egg while the male tends to remain on the host before dropping off and hence males normally remains on the host longer than females (Solomon et al., 2001).

Conclusion and recommendation

The present study results presented frequency distribution of five species of ticks belonging to two genera of ticks. Ticks were found infesting whole body of the cattle. However, ticks existences were more on udder/scrotum, perineum, brisket,

ano-vulva and dewlap. The distribution limits of ticks are not static but are determined by a complex interaction of factors such as climate, host density, host susceptibility and grazing habits. Further investigations on seasonal dynamics of tick population are essential for the continuous understanding of improved controls application. At the same time, it is better to use acaricides for the control of ticks throughout the area simultaneously in all households.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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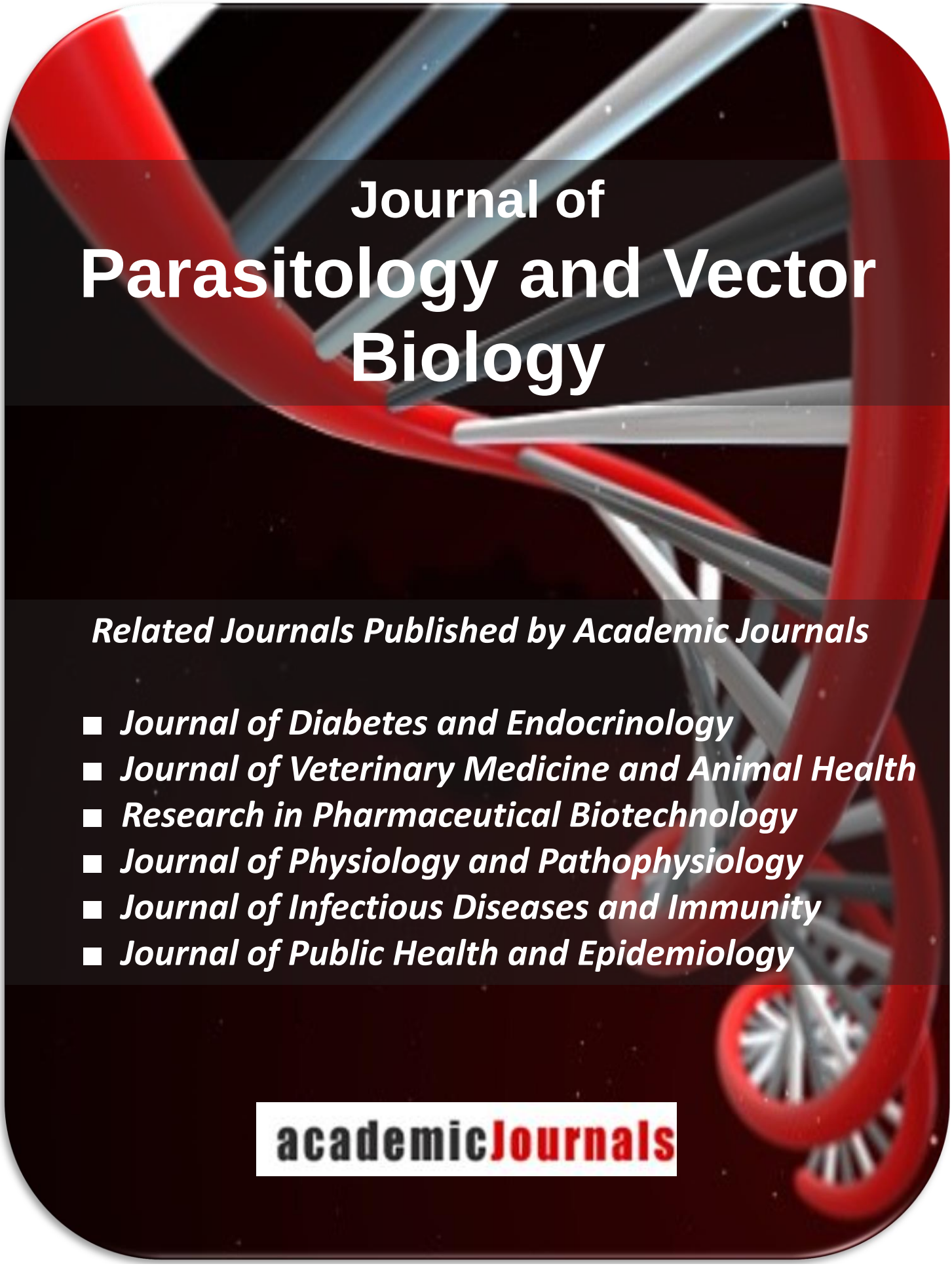

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