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Identification of bovine tick species and their prevalence in and around Sebeta Town, Ethiopia

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A cross sectional study was conducted from October 2013 to March 2014 in and around Sebeta town to identify different tick species infesting cattle, determine the prevalence and assess the risk factors for infestation. Adult ticks were collected purposively selected from 384 cattle and identified to the species level. Host related risk factors such as age, sex and body conditions were also collected. A total of 1,449 adult ticks were collected from different animal body parts. Seven tick species from three genera were identified. The tick species identified were *Rhipicephalus evertsi evertsi, Ambylomma variegatum, Rhipicephalus decoloratus, Hyalomma truncatum*, *Ambylomma cohaerence*, *Rhipicephalus preaxtatus* and *Hyalomma marginatum rufipes*. Higher infestation of tick was recorded in male animals as compared to female. However, the variation in prevalence between age, body condition and sex was not statistically significant. A higher male to female sex ratio of the different tick species was identified in this study. Majority of *Ambylomma* species were collected from the scrotum area and *Rhipicephalus* in the ano-vulvar area. Brisket and scrotum were the main sites of attachment for *Hyalomma* species. Thus, hand spraying of acaricide should target these identified predilection sites. In addition, we recommend further study to assess the ecological, managemental and host related factors influencing tick infestation, thereby appropriated control measure should be put in place.

Key words: Sebeta, cattle, ixodid tick, prevalence, species identification.

INTRODUCTION

Ethiopia has the largest livestock population in Africa. Among livestock, cattle play a significant socio-economic role in the livelihoods of the Ethiopian people (CSA, 2013). Despite the large population of animals, livestock productivity in Ethiopia is low and even below the average for most countries in Eastern and sub-Saharan African countries. This is due to prevailing animal diseases, poor nutrition, reproduction insufficiency and management constraints. Tick and tick-borne diseases are among the major health problems constraining livestock productivity in the country (Bekele et al., 2010).

Tick species are widely distributed around the world but they tend to flourish more in countries with warm, humid climates which are suitable to undergo their metamorphosis

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(Kilpatrick et al., 2007). Ticks are especially common and varied in tropical countries,where they cause considerable harm to livestock by transmission of many species of pathogens and causing direct parasitic damage. For an ecosystem to support ticks, the population density of the host species in the area must be high enough, and humidity must be high enough for ticks to remain hydrated (Magnarelli and Louis, 2009).

Ticks are blood-sucking obligatory ectoparasites of mammals, birds, reptiles and amphibians. They cause anemia, restlessness, loss of body condition, decrease in milk production and tick paralysis in animals, along with irritation by injury due to bites (Jonsson, 2006). Ticks are also efficient vectors of pathogens (Jongejan and Uilenberg, 2004). They transmit protozoa, rickettsiae, spirochaetes and viruses affecting livestock, humans and companion animals (Le Bars, 2009; Kaufman, 2010).

Ticks and tick borne disease are widely distributed in most parts of Africa, including Ethiopia and causes a tremendous economic loss to livestock production (Solomon et al., 2001). Although economic losses due to ticks (De Wall, 2000) are mainly due to vectoral role, financial losses associated with nagging irritation and damage of skins and hides are significant (Biswas, 2003; Garcia, 2003). Bekele (2002) estimated an annual loss of US$ 5,00000 from hide and skin downgrading from ticks, and approximately 65.5% of major defects of hides in Eastern Ethiopia were from ticks. Due to economic and veterinary importance of ticks, their control is a priority for many countries in tropical and subtropical regions (Lodos et al., 2000). Investigations directed toward determining the magnitude of infestation and the type of species involved can play a magnificent role in designing strategic control methods toward these parasites (De Castro, 1997). Moreover, a species level identification assist in the diagnosis of different tick-borne diseases and their respective control programs (Kassa and Yalew, 2012; Gedilu et al., 2014).

In Ethiopia, ticks are common in all agro ecological zones of the country (Pegram et al., 1981). 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. There are 47 species of ticks found on livestock (Bayu, 2005). Studying ticks on livestock under their natural conditions without any control measure is also useful for understanding the host parasite relationship and variation of tick population in different agro-ecological zone.

Even though there are some studies on ticks and TBDs in other parts of Ethiopia, there is no information on prevailing tick species infesting cattle in and around Sebate town. Therefore, relevant data on the distribution of ticks different tick species and factors predisposing cattle infestation is essential for the development of effective tick and tick borne disease control strategies. Therefore, this study was carried out to identify different tick species and their predilection sites, determine prevalence and risk factors associated with tick infestations in the study area.

MATERIALS AND METHODS

Study area

Sebeta is a town and also separate district, located in the Oromia Special Zone surrounding Finfinne (Addis Ababa) of the Oromia Region. This town has a latitude and longitude of 8°55′N 38°37′E/8.917°N 38.617°E and an elevation of 2,356 m (7,730 feet) above sea level. Sebeta town is located about 25 km southwest of Addis Ababa and has total area of 102,758 km^2. The annual mean rainfall registered in area ranges from 860 to 1200 mm. The ambient temperature averages 28°C in the area. In and around Sebeta town, different species of livestock are kept (CSA, 2013).

Study population

Cattle found in and around Sebeta town were the target population. The livestock population of the area comprised about 6395 cattle, 1702 sheep, 1123 goat, 1157 horse, 922 mule, 20616 donkey and 6520 poultry (Sebeta Awas Agricultural Office, 2014). Three hundred and eighty four (384) local breed, infested with ticks, were purposively selected and examined for the distribution and abundance of tick species. There were very few cross breed cattle under intensive management in the area. All cattle sampled for this study were kept under extensive management system.

Study design

A cross-sectional study was conducted to identify the tick species, population dynamics of tick species and their predilection sites on local cattle from October 2013 to March 2014. The animals were selected purposively (based on the existence of at least one tick on their body) as our aim is determination of prevalence of different tick species and their predictors. The age of animals was grouped as young (between 1 and 3 years) and adults (>3 years) according to the classification method used by Bitew (2011). Likewise, the body condition scores (good, medium and poor) were used, based on the criteria set by Nicholson and Butterworth (1996). Considering the time and resource at hand, we managed to collect ticks from 384 purposively sampled animals.

Tick sampling

Sample collection

The entire body surface of the host was inspected for ticks. After fully restraining the animal, all visible adult tick species were removed by hands or using special forceps holding the basis capitulum so as not to lose the mouthparts of the ticks. Collection of ticks was done on brisket, back, side, ventral (abdomen), under tail and ano-vulval areas. Ticks from each animal and from each site were collected and placed in separate universal bottles containing 70% ethyl alcohol that had been pre-labeled. Required information like date of collection, age of animal, sex of animal, site of collection were recorded. Tick species identification was done using a stereomicroscope at the Sebeta National Animal Health Diagnostic and Investigation Centre Laboratory.

Tick identification

Investigation procedure required both field works and laboratory

Table 1. Total number and prevalence of identified tick species.

Tick species	Numbers of ticks identified (Prevalence)	95% CI of the prevalence
R. decoloratus	155 (10.7)	9.15-12.40
A. variegatum	331 (22.9)	20.69-25.07
A. coherence	35 (2.4)	1.63-3.26
H. truncatum	124 (8.56)	7.16-10.12
H. marginatum rufipes	12 (0.83)	0.43-1.44
R. evertsi evertsi	770 (53.4)	50.55-55.74
R. preaxtatus	22 (1.52)	0.95-2.29

CI: Confidence interval.

investigation of collected sample. Tick species were identified by the shape and length of the capitulums, the color of the body, the color of legs, position and presence or absence of punctuations on the body, shape of the eyes and length of the mouth parts according to Walker et al. (2003).

Statistical analysis

The collected data was analyzed by statistical software, namely, SPSS version 20 (SPSS INC. Chicago, IL). Prevalence was determined by the formula described by Thrusfield (2005) as the rate of number of infested animals and total number of sampled animals. Associations between explanatory variables (age, sex and body condition score) and outcome variable (infestation status with specific tick species) was done using chi-square (χ^2) test. In all analysis, all statistics were considered significant at $p < 0.05$ and 95% confidence interval.

RESULTS

A total of 1,449 Ixodid ticks were collected from ten body region of 384 cattle. Seven different tick species in three genera were indentified in which three species belonged to the genera *Rhipicephalus*, two species each belonged to the genus *Ambylomma,* and *Hyalomma*. The tick species identified were *Rhipicephalus evertsi evertsi*, *Ambylomma variegatum*, *Rhipicephalus decoloratus*, *Hyalomma truncatum*, *Ambylomma cohaerence*, *Rhipicephalus preaxtatus* and *H. marginatum rufipes* in descending order of prevalence as shown in Table 1. *R. evertsi evertsi* was the most prevalent (53.4%), while *Hyalomma marginatum rufipes and R. preaxtatus* were the least abundant (2.90%) (Table 1).

In the present study, the prevalence of all tick species was higher in male animals than female animals, except *A. variegatum*, *R. decoloratus* and *R. preaxtatus* which had a higher prevalence in female animals although all the differences were not significant ($p > 0.05$) (Table 2). The present study indicated that different ticks have different predilection sites on the host's body. The favorable predilection sites for *R. decoloratus* was the back, ventral side of the animal; *A. variegatum* and *A. coherence* were scrotum and brisket; *H. truncatum,* brisket and scrotum; *H. marginatum rufipes*, scrotum and brisket; *R. evertsi evertsi* and *R. preaxtatus* under tail and anus. The most favorable predilection sites of different tick species and sex ratio between male to female ticks species is as shown in Table 3.

Based on the body condition of the animals, high prevalences of *A. variegatum*, *A. coherence* and *H. truncatum* were recorded in cattle with medium body condition, whereas low prevalence was recorded in cattle with good body condition. However, this study could not detect a significant difference ($p > 0.05$) in prevalence of the different tick species among the three categories of animal body conditions scores (Table 4). The prevalence of most tick species was higher in adult animals as compared to young ones except in the case of *R. evertsi evertsi* and *A. coherence*, which were more prevalent in young animals (Table 4). However, there was no statistical significant difference between infestation with the specific tick species and the age category of the animal ($p > 0.05$). The specific species of ticks and its χ^2 association with the age of the animal as shown in Table 5.

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 present study, *R. evertsi evertsi* were found to be the most abundant tick species in and around Sebeta town (53.4%). Gashaw (2012) reported that *R. evertsi evertsi* was the most prevalent (36.6%) in and around Gonder town. Tiki and Addis (2011) also reported *R. evertsi evertsi* as the second most abundant (29.29%) tick species in and around Holeta. Similarly, Tamiru (2008) in Asella and Hussen (2009) in Bako reported a 26.8 and 21.5% prevalence of *R. evertsi evertsi*, respectively. The high prevalence of *R. evertsi evertsi* indicates that this tick species is wide spreading in the country. According to Morel (1980), the native distribution of *R. evertsi evertsi* in Ethiopia is likely to be connected with middle height dry savannas and steppes in association with

Table 2. Prevalence of tick species according to sex of animal.

Tick species	Sex of animal	No. of animal examined	No. of infested animals (prevalence)	χ^2	P-value
R. decoloratus	Male	214	35 (15.9)	1.420	0.233
	Female	170	34 (20.6)		
A. variegatum	Male	214	47 (21.9)	2.378	0.123
	Female	170	49 (28.8)		
A. coherence	Male	214	11 (5.1)	0.581	0.446
	Female	170	6 (3.3)		
H. truncatum	Male	214	38 (17.8)	0.237	0.627
	Female	170	27 (15.9)		
H. marginatum rufipes	Male	214	8 (3.4)	1.326	0.249
	Female	170	3 (1.8)		
R. evertsi evertsi	Male	214	122 (57)	2.551	0.110
	Female	170	83 (48.8)		
R. preaxtatus	Male	214	6 (2.8)	0.006	0.936
	Female	170	5 (2.9)		

Table 3. Major predilection site and sex ratio of the identified tick species.

Tick species	No. of ticks by sex		Sex ratio (male to Female)	Predilection site of ticks (proportion of ticks collected from each site; %)
	Male	Female		
R. decoloratus	0	155	0:155	Neck (21.3), back (24.7), lateral side (23), ventral (31)
A. variegatum	307	24	12.79:1	Scrotum (36.1), udder (21.4), brisket (21.5), teat (20.2)
A. coherence	30	5	6:1	Scrotum (65.7), udder (14.3), brisket (14.3), teat (5.7)
H. truncatum	88	36	2.44:3	Scrotum (28.2), udder (11.3), brisket (48.4), teat (12)
H. marginatum rufipes	9	3	3:1	Scrotum (41.7), udder (16.3), brisket (33.3), teat (8.3)
R. evertsi evertsi	481	289	1.66:1	Anus (49), vulva (11) and under tail (50.9)
R. preaxtatus	14	8	1.73:1	Anus (40.9), vulva (9.1) and under tail (50)

abundant ruminant populations. In addition, Pergam et al. (1981) stated that this tick species shows no apparent preference for particular altitude, rainfall zones or seasons which might have contributed to its wide distribution.

A. variegatum was the second prevalent tick species of cattle in the study area (25.00%). Similar to our study, Pawlos and Derese (2013) reported a 25.42% prevalence of *A. variegatum* in Humbo district. However, reports from different parts of Ethiopia such as Tessema and Gashaw (2010) in Asela, Tiki and Addis (2011) in Holeta, Seyoum (2005) and Mehari (2004) in Awassa, indicated that *A. variegatum* as the most abundant tick species in the respective study areas. The difference in abundance could be due to the geographical location as *A. variegatum* was reported to be the highest in number in the highland and high rainfall areas. Solomon et al. (2001) stated that *A. variegatum* causes the greatest damage to hides and skins because of its long mouth part, which renders the commodity valueless on world market if the infestation was high. The abundance of *A. variegatum* in study area may be associated with massive damage to hides and skin. Furthermore, ulcers caused by this tick species can be favorable sites for secondary bacterial infection like *Dermatophilus congolensis* and other pyogenic organism.

The prevalence of *R. decoloratus* was 18% and it was the third tick species in abundance in the study area. Tiki and Addis (2011) and Tamiru (2008) reported almost the same level of prevalence (18.13 and 18% of *R. decoloratus*) from Holeta and Asella, respectively. In general, the

Table 4. Prevalence of different tick species association with body condition of animal.

Tick species	Body condition	No. of examined animal	Prevalence No (%)	χ^2	P-value
R. decoloratus	Poor	127	17 (13.2)	2.823	0.244
	Medium	104	20 (19.2)		
	Good	153	32 (20.92)		
A. variegatum	Poor	127	32 (25.20)	0.384	0.852
	Medium	104	28 (26.92)		
	Good	153	36 (23.53)		
A. coherence	Poor	127	5 (3.94)	0.607	0.738
	Medium	104	6 (5.8)		
	Good	153	6 (3.92)		
H. truncatum	Poor	127	22 (17.32)	0.797	0.671
	Medium	104	20 (19.32)		
	Good	153	23 (15.03)		
H. marginatum rufipes	Poor	127	4 (3.15)	0.072	0.965
	Medium	104	3 (2.88)		
	Good	153	4 (2.61)		
R. evertsi evertsi	Poor	127	76 (59.84)	3.494	0.174
	Medium	104	50 (48.08)		
	Good	153	79 (51.63)		
R. preaxtatus	Poor	127	4 (3.15)	0.458	0.795
	Medium	104	2 (1.92)		
	Good	153	5 (3.28)		

results of our study are similar to the reports from many other parts of Ethiopia such as in Rift Valley region of Ethiopia (Solomon and Kassa, 2001) and Bale (Dejenu, 1988). *R. decoloratus* is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually (Pegram et al., 1981).

H. truncatum was recorded as the forth most prevalent (16.9%) tick species in the study area. A very low prevalence (0.56%) of *H. truncatum* has been reported in Borena (Regassa, 2001). The higher prevalence of this tick species in Sebeta might be due to the geographical location or agro ecology of the area as *H. truncatum* is the highest in number in the mid highland and high rainfall areas (Sebeta) as compared to Borena which is in lowland and also receive low rainfall. In sub-Saharan Africa, *H. truncatum* is very widespread and often common. Its abundance may be influenced by the abundance of hare that are the preferred hosts of the immature stages (Walker et al., 2003).

A 4.4% prevalence of *A. cohaerence* recorded in the present study is almost the same as that reported by Tiki and Addis (2011), who reported 5.02% prevalence in and around Holeta town. However, in Western Ethiopia, where the climate is humid for much of the year, *A. cohaerence* is the most prevalent and abundant tick on cattle (Pegram et al., 1981). In a tick survey conducted in Western Ethiopia, *A. cohaerence* was found to be the most prevalent in Mezan Teferi (Seid, 2004) and Jimma (Yitbarek, 2004) with a prevalence of 50.5 and 83.1%, respectively.

H. marginatum rufipes was the least abundant tick species collected and represented only 2.9% of the total counts. Hussen (2009) in Bako, Tamiru (2008) in Assella and Tiki and Addis (2011) in and around Holeta also reported a prevalence of 1.2, 2.5 and 1.86%, respectively. The low prevalence of this tick species in the study area as stated could be due to the fact that *H. marginatum rufipes* is mostly found in arid parts of tropical Africa that receive about 250 to 650 mm annual rainfall (Hoogestraal, 1956) and rare in the western and central highland of the country. In Ethiopia, altitude is often between 1000 to 2500 m above sea level and this makes the presence of this parasite to be very rare (Pegram et al., 1981). In the same way, *R. preatextatus*

Table 5. Prevalence of specific tick species in association with the age of the animal.

Tick species	Age category of Animal	No. of examined animal	Prevalence No (%)	95% CI of the prevalence	χ^2	p-value
R. decoloratus	Young	30	3 (10)	2.1-2.7	1.402	0.236
	Adult	354	66 (18.6)	14.7-23		
A. variegatum	Young	30	5 (16.7)	5.6-34.7	1.205	0.236
	Adult	354	91 (25.70)	21.2-30.6		
A. coherence	Young	30	3 (10.00)	2.1-26.5	2.389	0.122
	Adult	354	14 (3.95)	2.1-6.5		
H.truncatum	Young	30	3 (10.0	-	1.110	0.292
	Adult	354	62 (17.5)	-		
H. marginatum rufipes	Young	30	0 (0.0)	0.0-0.1	0.960	0.327
	Adult	354	11 (3.10)	1.6-5.5		
R. evertsi evertsi	Young	30	21 (70.0)	5.1-85.3	3.610	0.057
	Adult	354	184 (51.0)	46.7-57.3		
R. preaxtatus	Young	30	0 (0.00)	0.0-0.1	0.960	0.327
	Adult	354	11 (3.10)	1.6-5.5		

was also a rare (2.9%) tick species in the study area. In Borana, Ragessa (2001) reported the prevalence of *R. preatextatus* to be as low as 0.28%, which is lower than with the current finding. *R. preataxtatus* occurs in a wide range of climatic regions from temperate high land areas of Ethiopia and Kenya, through to savanna and steppes of East Africa to desert climates in North East Africa and Eastern Sahara (Walker et al., 2003).

The male to female sex ratio of all tick species except *R. decalaratus* is greater than suggesting that the male outnumbered the female ticks. Tessema and Gashaw (2010) also reported a higher male to female sex ratio of tick species in and around Asela. The male to female rations of *R. decoloratus, R. evertsi-evertsi, A. variegatum, A. cohaerence,* and *H. truncatum* in the present study is similar to previous reports (Seyoum, 2001; Solomon et al., 2001; Tadesse et al., 2012; Gedilu et al., 2014). The more plausible explanation why male ticks outnumbered the females could be due to the fact that fully engorged female tick drops off to the ground to lay eggs while male tend to remain on the host up to several months to continue feeding and mating with other females on the host before dropping off (Solomon et al., 2001). The females of *R. decoloratus* outnumbered males in this study probably due to small size of male, which may not be seen during collection (Tessema and Gashaw, 2010).

Each tick species have their own predilection site of attachment on their host. Ticks are known to be distributed in different parts of the host body factors such as host density, interaction between tick species, time, season and inaccessibility for grooming determine the attachment site of ticks (Solomon and Kassa, 2001). The predilection sites of different tick species found in this study corroborate with previous reports from North Wollo zone and Asela (Seyoum, 2001; Behailu, 2004).

Although, the association was not statistically significant, the proportion of tick infestation was higher in adult than younger animals in study area. This finding agrees with the finding of Feseha (1997), Tessema and Gashaw (2010) and Tiki and Addis (2011), who reported a higher proportion of infestation in adult cattle than the younger ones. A relatively higher proportion of infestation in adult may be due to outdoor management and long distant movement of adult animals to search for food and water as compared to younger animals, so the chance of exposure is higher (Pawlos and Derese, 2013).

The prevalence of all tick species was higher in male animal than female animals, except *A. variegatum*, *R. decoloratus* and *R. preaxtatus.* Similarly, other authors (Hussen, 2009; Pawlos and Derese, 2013) reported a higher tick infestation in male animals than females. This minor variation might be due to the fact that female animals may receive good management for dairy purpose whereas male animals grazing on field might be exposed to tick infestation.

In the study area, the highest prevalence of *A. variegatum, A. coherence* and *H. truncatum* was recorded

in cattle having medium body condition and the lowest in good body condition. Similarly, Pawlos and Derese (2013), reported a higher proportion of tick infestation in medium body conditioned animals as compared to those with poor body condition and good body conditioned animal. This might be due to the fact that medium body scored animals have reduced resistance and are exposed to ticks when grazing on the field. Poor body conditioned animals might be kept at home due to their inability to walk to distant areas and thus less exposed to ticks as compared to medium sized animals. Well-fed animals could be very resistant to any kind of diseases including ticks infestation, when they grazed in the field or are kept at home (Solomon et al., 2001).

The identification of several tick species in this study indicates the economic importance of the ticks and potential existence of tick borne diseases in the area. This warrants study on the economic importance of tick and the surveillance of tick borne diseases in the area. Despite the important findings, the result of this study should be interpreted with the context of its limitation in that all the study animals were obtained using purposive sampling. These could compromise representativeness of the sample and hence inference of the result to the target population.

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Conflict of interest

The authors would like to declare that they have no conflict of interest.

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