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Identification of Major Ixodid Ticks on Cattle in and Around Haramaya Town, Eastern Hararghe, Ethiopia

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Abstract: A cross sectional study was conducted from November 2010 to March 2011 to identify the major tick species in and around Haramaya Town, Ethiopia. A total of 462 cattle were examined for the presence of hard ticks and 186 were found positive yielding an overall prevalence of 40.26%. From the total of 1446 adult ticks collected two genera, *Ambylomma* and *Rhipicephalus* were identified; where *Ambylomma* takes the dominance with 47.16% prevalence. From those two genera five species were identified, *Ambylomma varigatum*, *Ambylomma cohaerens*, *Rhipicephalus* (*Bophilus) decoloratus*, *Rhipicephalus evertsi evertsi* and *Rhipicephalus pulchelleus*. The quantitative hierarchy of the tick species was *A. variegatum* (38.87%), *R. (B.) decoloratus* (31.54%), *R. eversti eversti* (14.66%), A. *cohaerens* (8.30%) and *R. pulchulus* (6.64%). Therefore the result indicated that *A. varigatum* and *A. decoloratus* are the most abundant tick species of cattle in Haramaya town. On the sex ratio calculation for ticks, male ticks was found dominant once as compared to the counterparts. The result of this study also demonstrates a significant variation ($P< 0.05$) on infestation between local and cross breed cattle and also between male and female cattle where, infestation found to be significantly higher in local breed cattle and male cattle. Though a comparatively higher infestation was found on adult animals as compared with young animals and the difference was not significant ($P>0.05$).

Key words: Ethiopia · Haramaya · Ixodidae · Ticks · *Rhipicephalus* · *Ambylomma*

INTRODUCTION

Ethiopia ranked first in Africa in livestock population until very recently, having approximately 44.3 million cattle, 46.9 million small ruminants, more than 1 million camels and 4.5 million equines and 40 million chickens [1]. Livestock production plays an important role in sustainable agriculture. It provides draught power, meat, milk, manure, hides and skin [2]. In the highlands of Ethiopia livestock are mainly kept to provide draught power which is estimated to account for about 60% of the total value of cattle products and services about 30-35% of agricultural gross domestic product (GDP) and more than 85% of farm cash income. The livestock sector also contributes about 13-16% of the total GDP. In addition cattle are the major source of foreign exchange [3].

Despite the relatively large animal population with high potential for production, the performance of the Ethiopian livestock sector is disturbingly poor. It does not even compare favorably with the average performance of East African and Sub-Saharan countries. A marked difference is observed between the yield per productive animal and the yield per herd/flock [4, 5]. Poor health and productivity of animals due to disease is considered as the major stumbling block to the potential of the cattle industry [6].

The other factors that contribute for low livestock productivity could be water scarcity, socio-economic limitations and institutional constraints [7]. The prevalence of various skin problems caused by lice, tick and mange mites results in serious economic loss to smallholder farmers, the tanning industries and the country as a whole. They can result in mortality of animals, decreased production, downgrading and rejection of skin and hide [8].

In Africa, ticks and tick borne diseases are considerable to be the most important animal disease problems. Ticks and tick borne diseases affect 90% of the world cattle population and are widely distributed throughout the world, particularly in tropical and subtropical countries, they represent an important proportion of all animal disease affecting the livelihood of

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poor farmers in the growth of the livestock industry, which of fundamental importance to the rural people in sustaining not only their food supply, but also their daily income [9]. In Ethiopia, ticks occupy the first place amongst the external parasites and the economic losses incurred when they infest livestock particularly cattle are enormous [10].

The ticks parasitizing livestock are categorized in to two families; Argasidae ("Soft ticks") and Ixodidae ("Hard ticks"). Ixodidae ticks occur in the temperate as well as in the tropical and sub-tropical regions of the world. They adversely affect animal health especially in the tropics. Ticks and tick borne diseases constitute a major constraint to livestock production in tropical and sub-tropical areas.

Ixodidae ticks are important in veterinary medicine, primary as vectors of a wide spectrum of pathogenic microorganisms, such as protozoa, rickettsia and viruses. In addition they may also cause direct damage such as reduction of quality of hides, reduction in live weight gain, anemia, toxemia and paralysis. These ticks have tough, leather like skin and live from blood of the host animal which they attack in large numbers [11].

Several tick species are widely distributed in Ethiopia. The major tick genera recorded are *Amblyomma*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. Over 60 tick species are known to exist in the country. The most economically important and wide spread ticks are *A. variegatum* and *R.* (*B.) decoloratus*. The distribution of *A. variegatum* is similar to that of *R.* (*B.) decoloratus* and together these two species constitute more than half of the total collections. *A. variegatum* and *R. pulchellus* are confined to semi-arid areas [12] and low land tick densities are usually greater than those in the highlands. *Ambylomma* and *Rhipicephalus* ticks are mainly parasites of livestock. Tick population levels in local cattle are generally low for most of the year, but the number increases during rainy season [13].

Acaricide application is still the main tick control method in Ethiopia. Multitudes of acaricides are used and their application seems to be regulated primarily by availability. Apart from the use of chemical compounds for tick control, certain-cultural practices such as hand picking of ticks, burning with hot iron and plant preparations are widely used by cattle owners in rural areas. Ticks on indigenous cattle are treated whenever the farmers bring their animals to the veterinary clinics either for tick control or due to other complaints [14].

The use of resistant cattle is becoming increasingly important as the cost of acaricides in hard currency is rising. Resistance must be balanced against productivity. Highly resistant indigenous cattle may require minimum protection against ticks or the disease they transmit but have low potential for milk production. Cross breeding with Taurine milk cattle provides the required improvement in productivity or potential for the same, but is accompanied by lowered resistant to ticks. The most approach is crossing of indigenous resistant dairy Zebu type with Taurine breeds, in which the proportion of each component can be adjusted to suit the management system and environmental conditions [16].

Tick resistant cattle breeds are often able to control tick infestations, so that burden never reaches life-threating levels. Millions of cattle survive in developing countries in the absence of active ticks and tick borne diseases control measures. Their survival is explained by the concept of enzootic stability [17].

Indigenous breeds in enzootic areas are far less susceptible than those from other regions, undoubtedly because of natural selection over many generations. This resistance of indigenous population appears to more pronounce in cattle than in small ruminants [18]. In Ethiopia, the major cattle tick borne diseases are Anaplasmosis, Babesiosis, Ehrlichiosis and Theileriosis. There are no reported cases of bovine tropical Theileriosis (*Theileria annulata*) or east coast fever (*Theileria parva*) [12]. Appropriate control and prevention measures can be applied on ticks and tick borne diseases once the type of ticks in the area are identified, however, there is no established data on tick genera and species in and around Haramaya town, Ethiopia.

Therefore, the objectives of this study are to identify major genera and species of major ixodidae ticks infesting cattle in and around Haramaya town, Ethiopia and to recommend appropriate tick control measures based on the result.

MATERIALS AND METHODS

Study Area: Haramaya town is located in the eastern Hararghe zone of Oromia region, Ethiopia, 14 km from west of Harar and 508 km east of Addis Ababa. According to Haramaya district agricultural statistics information, the district has about 63,723 cattle, 13,612 sheep and 20,350 goats, 15,978 donkeys, 530 camels and 42,035 chickens. Geographically, it is located $9^0$26'N latitude and $42^0$3'E. Topographically, it is situated at altitude of 1600-2100 m above sea level with the mean annual temperature and relative humidity of 18^0C and 68% respectively. The Haramaya area receives an average annual rain fall of approximately 900 mm, with a bimodal distribution pattern, picking in mid-April and mid-August.

Study Population: The study was conducted on local and cross breeds of cattle found in and around Haramaya town.

Study Design: A cross sectional study was conducted from November 2010 to March 2011 in and around Haramaya town to identify the major ixodid ticks. Information like age, sex, breed and place of origin were recorded by interviewing the owners of animals at the time of sampling. Ticks collected from different body parts of the animals were stored in a universal bottle having 10% formalin and the transported to Haramaya University veterinary parasitology laboratory for identification using stereomicroscope.

Sampling and Sample Size Determination: Animals were sampled by simple random sampling technique at watering points, grazing field and veterinary clinics found around Haramaya town. The required sample size for the study was determined by the formula given by Thrusfield [19].

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

Where, n = required sample size
P_{exp} = expected prevalence (0.5)
d = desired precision (5%)

Using the above formula the required sample size was calculated to be 384. Though, the desired sample size was 384 to increase the probability of estimating the actual population prevalence additional samples were collected and a total of 462 animals are sampled.

Tick Collection and Identification: Ticks were collected, after casting the animals, by using thumb forceps and manually without causing damage to the head and other body parts of the ticks. Ticks were collected from the right side of the animals on different predilection sites (Body zones) including the ear, neck, dewlap, abdomen, anus, hip, udder, scrotum and base of tail following the procedure suggested by Kaiser [20]. The collected ticks were put in to universal bottles, which are labeled according to the site of collection, containing 10% formalin. All ticks collected from different animals and body zones were separately examined under stereomicroscope and identified to the species level using standard keys [21].

Data Entry and Statistical Analysis: The data collected were entered and managed in Microsoft excel. An intercooled Stata 7 software statistical program was employed for the data analysis. The prevalence of ticks was determined by dividing the number of positive samples by the total sample size and was expressed as percentage. Chi-square (χ^2) test was used to asses if there was a statistically significant difference in tick infestation between ages, breed and sex groups. For this analysis P-value less than 0.05 was considered significant whereas P-value greater than 0.05 considered non-significant.

RESULTS

Prevalence of Ticks on Cattle: In this survey a total of 462 cattle where 384 local and 78 cross breeds of cattle were examined and a total of 1446 adult ticks were collected. Out of the 462 examined animals 186 were found positive for ticks and the prevalence was 40.26%.

Genera and Species of Ticks Identified: All collected ticks were identified and categorized in to two genera namely *Ambylomma* and *Rhipicephalus*. Under the genus *Ambylomma* two species were identified; *A. variegatum* and *A. cohaerens*. This genus contained 47.18% of the total tick collected, where *A. variegatum* is the most abundant species and accounts 38.87% of the genus. The genus *Rhipicephalus* accounts for 52.84% of the total adult ticks collected and *R. (B.) decoloratus, R. pulchellus* and *R. eversti eversti* were the species identified. *R. (B.) decoloratus* is the most abundant and prevalent tick from the genus *Rhipicephalus* and it contains 31.54% of the genus and followed by *R. pulchellus* which accounts for 6.64%.

Table 1: Major tick genera and its distribution in the study area

	Tick genera					
	Ambylomma		*Rhipicephalus*		Total	
Sites	No	%	No	%	No	%
Ifaoromia	256	46.63	293	53.37	549	37.97
Tugigabisa	216	44.81	266	55.19	482	33.33
Adelle	112	46.28	130	53.72	242	16.74
Haramaya	98	56.65	75	43.35	173	11.96
Total	682	47.16	764	52.84	1446	100

Table 2: Major tick species and its distribution in the study area

	Tick species											
	A. variegatum		*A. cohaerens*		*R. everstieversti*		*R. pulchellus*		*R. (B.) decoloratus*		Total	
Sites	No	%	No	%	No	%	No	%	No	%	No	%
Ifaoromia	215	39.16	41	34.17	75	35.38	22	22.92	196	42.98	549	37.97
Tugigabisa	183	37.97	33	6.85	84	17.43	44	17.43	138	28.63	482	33.33
Adelle	88	36.63	24	9.92	35	14.46	16	6.61	79	32.6	242	16.74
Haramaya	56	43.93	22	12.72	18	10.40	14	8.09	43	24.85	173	11.96
Total	562	38.87	120	8.30	212	14.66	96	6.64	456	31.54	1446	100

Sex Ratio: During the study the collected ticks were identified as male and female the proportion of male ticks was found higher than its counterparts.

Attachment Site: In the study each species of ticks were collected from various body regions of cattle. The observed attachment sites for each species of ticks during this study was summarized and shown in table 4.

Animal Related Risk Factors: Animals with different breed, age and sex were examined to identify the relation of these factors to the prevalence of the ticks. Ticks are more prevalent in local than cross breeds cattle and young cattle than adults. Base on the sex groups ticks are more prevalent in male than females.

Table 3: Sex ratio of major tick species in the study area

Tick species	Male	Female	Sex ratio	Total
A. variegatum	324	238	1.36:1	562
B. decoloratus	358	98	3.65:1	456
R. everstieversti	142	74	1.9:1	216
A. cohaerens	78	42	1.86:1	120
R. pulchellus	56	36	1.55:1	92
Total	958	488	1.96:1	1446

Table 4: Attachment site of major tick species

Species of tick	Body region (attachment site)
A. variegatum	Scrotum, udder, dewlap, vulva, brisket
A. cohaerens	Scrotum, udder, dewlap, vulva, brisket
R. everstieversti	Tail (base of tail), vulva, anus
R. pulchellus	Tail (base of tail), vulva, anus
R.(B.) decoloratus	Udder, tail, scrotum, belly

Table 5: Result in breed groups

Breed	Total No of animals examined	No of positive (%)
Local	384	178 (46.36)
Cross	78	8 (10.26)
Total	462	186 (40.26)

$\chi^2 = 35.125$ P = 0.001

Table 6: Result in age groups

Age	Total No. of animals examined	No of positive (%)
Adult	333	139 (39.03)
Young	129	56 (43.41)
Total	462	186 (40.26)

$\chi^2 = 0.793$ P = 0.399

Table 7: Result in sex groups

Sex	Total No. of animals examined	No of positive (%)
Female	287	101 (35.19)
Male	175	85 (48.57)
Total	462	186 (40.26)

$\chi^2 = 80.092$ P = 0.004

DISCUSSIONS

In this survey a total 1446 ticks were collected from a total of 186 local and cross breed animals and the overall prevalence was 40.26%. And this finding is in agreement with the findings of Solomon *et al*. [22] showed that the prevalence and intensity of infestation of ticks were generally low during the dry season but higher during the rainy season. However, it is different from the findings of Regassa [23] who reported an overall prevalence of 82% in Borana province of southern Oromia. This difference could be due to the difference in the agro climatic condition of the study area.

Two genera of hard ticks were identified, namely *Ambylomma* and *Rhipicephalus*. *Ambylomma variegatum*, *A. cohaerens*, *R. eversti eversti*, *R. pulchellus* and R. (*B.) decoloratus* was the species of ticks identified in the study area.

Ambylomma variegatum was the most abundant of all tick species comprising 38.87% of the collected ticks in the study site. This finding is in similar with the findings of Gulilat [24] and Yehualash *et al*. [25] who reported 40.08% of *A. variegatum* and this is also favored by the reports of Pegram *et al*. [12], Hoogstral [26] and Morel [27]

who reported *A. variegatum* as most common and widely distributed cattle tick in Ethiopia. It has a great economic importance, because it is an efficient vector of Cowdria ruminantum (*Ehrlichia bovis*) and greatest damage to hide, due to its long mouth parts, so it will reduce the value on world market [28].

Rhipicephalus decoloratus was identified as the second tick species in the study sites constituting 31.54% of the total ticks collected. This finding is consistent with the findings of Yismashewa [29] who reported mainly in low and highland areas during rainy season (March to April). However, this finding is different with the findings of Teshome *et al*. [30] who report 80% for *B. decoloratus* from the total tick count. This difference may be due to the seasonal and agro ecological variation that exists among the studies. This species is reported to be widely distributed in the central rift valley parts of Ethiopia [12]. Dhuffera [31] and Gashaw [32] also recorded higher number of *Rhipicephalus* (formerly *Boophilus)* in areas with high rain fall.

In this study *R. eversti eversti* was the third abundant tick species in the study area constituting 14.66% of the total adult tick collected. In contrast to this study, the geographical distribution survey of ticks conducted in Gondar Awraja by Eshetu [33] found that *R. everesti everesti* was the most common abundant tick species in the area. This may be due to the reason that all stages of *R. eversti everesti* were less active during dry season [34]. But Bekele [35] reported that this species had not showed specific preference for particular environment.

In this study *R. eversti eversti* was recorded as the third most abundant tick species in these study accounts 14.66% of the total ticks collected. This finding is in line with Solomon *et al*. [36]. Hoogstral [26] also described its wide distribution throughout the Ethiopian faunal region. *Rhipicephalus everesti everesti* is also known to convey tick paralysis in Harar, Ethiopia [27]. So, the findings of this study agree with the above statement because the climatic condition of Harar is relatively similar with climatic condition of Haramaya woreda. Bekele [35] also reported that this species never showed specific preference for a particular environment.

Ambylomma cohaerens was the fourth abundant tick species in Haramaya woreda constituting 8.30% of the total ticks collected. This study indicates that *A. cohaerens* is not common in the study area where there is shortage of rain fall in the year. This result has agreement with the report stated by Feseha [10] as *A. cohaerens* is abundant in areas where climate is humid most of the year. De Castro [37] also reported this tick species is most common in western Ethiopia. Regardless of its prevalence and place of collection the presence of *A. cohaerens* in different parts of Ethiopia has been reported by various researchers Kaiser [20] in western Ethiopia, Mekonnen *et al*. [38] in central Ethiopia; Belete [39] in Gojjam, Tesfanesh [40] in Northern Omo, Surafel [41] in Tigray and Eshetu [33] in Gondar.

Rhipicephalus pulchellus was the least abundant tick species in the study area constituting 6.64% of the total ticks collected. Feseha [10] reported that it is highly distributed in the arid regions, chiefly in the rift valley and east warred. There are only two records from the west of the valley so far southern range land of Ethiopia. Solomon *et al*. [6] and Dejenu [42] reported the abundant of this tick species. *Rhipicephalus pulchellus* has been implicated as a probable vector of Nairobi sheep disease that exists in north of Somali and clinical case have been reported in Jijiga (South east Ethiopia). The disease back out with tick activity and stops when it is fought back, the distribution of the *R. pulchellus* coincide with that of the disease it transmit [27]. So the finding of this tick species in this study, which accounts for 6.64% of the total ticks collected, is supported by the above statement.

The male to female ratios recorded in the present study for *A. variegatum*, *A. cohaerens*, *R.* (*B.) decoloratus*, *R. eversti eversti* and *R. puluchellus* were similar to the earlier work of Solomon *et al*. [36] and Kaiser *et al*. [43] in more number of males. This is most probably attributed to the fact that fully engorged female ticks drop off to the ground to lay eggs while males tend to remain on the host up to several months later to continue feeding and mating with other females as has been observed by Solomon and Kaaya [44].

With regard to predilection site for attachment, different tick species shows different site preferences. *A. variegatum* and *A. cohaerens* found in scrotum, udder, dewlap, vulva and brisket whereas the *B. decoloratus* species were found on the dewlap, udder, belly and scrotum. *R. eversti eversti* and *R. pulchellus* showed high preference to the anogenital region of the body and then followed by the inside of the ear.

In this study different animal related risk factors were studied to determine whether there is a significant variation in tick infestation between and among different groups of animals with the suspected risk factors. The result shows that the tick infestation was significantly higher in local breed cattle as compared with cross breed cattle, where $P < 0.05$ and this finding is in agreement with the findings of Kaiser *et al*. [43] who reported the presence of significant variation between breed groups.

The higher prevalence of tick infestation in local breed animals may be attributed to the currently existing modified animal husbandry practices where cross breed (High yielding) animals are kept most of the time indoor with intensive care whereas local breed cattle are kept under extensive farming system. Therefore, the chance of occurrence in local breed cattle is greater than cross breeds.

The proportion of tick infestation was higher in adult animals as compared to young animals. However, there was no statistically significant difference $P > 0.05$ and the higher proportion may be due to outdoor management and of long distant movement of adult animals to search feed and water as compared to young animals, so the chance of exposure is higher. This finding is also in agreement with the findings of Feseha [45] which is higher proportion in adult cattle.

There is also statistically significant difference ($P < 0.05$) in infestation rate among different sex groups where, higher proportion was recorded in male animals as compared to their counterparts. This variation may be associated with that female animals are kept properly in the house with good management system for dairy purpose whereas male animals are grazing the field whole day so that this may exposed to tick infestation.

CONCLUSION

The overall prevalence in this study indicates 40.26% the wide spread nature of ticks in the study areas. The most abundant and distributed tick species in the study area in decreasing order are A. variegatum, R. (B.) decoloratus, R. eversti eversti, A. cohaerens and R. pulchellus. The attachment site for most of the species were udder, brisket, scrotum, dewlap, belly, ear and anogenital organs. Breed, sex and age of animals were considered as potential risk factors where, tick infestation was found significantly higher in local breed cattle as compared to local breed once. The infestation in male animals is also found to be significantly higher than female cattle. However, infestation between the different age groups was found insignificant.

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