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Identification and prevalence of ixodid tick in bovine at Bedele district, Oromiyia Regional State, Western Ethiopia

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A cross sectional study was conducted with the aim of identifying and estimating the prevalence of cattle tick infestation with respect to host related factors in Bedele district, Western Ethiopia. A total of 384 cattle were considered in the study, and both physical examination and microscopical investigation were employed. The study revealed that there was high tick infestation in the study with an overall prevalence of 315 (82%). Four species of ixodidae ticks were identified from the study area. Among the ticks, *Amblyomma cohaerens* (41.5%) was the most prevalent tick species while *Amblyomma variegatum* was the least prevalent (6.5%) tick species recorded in the study. All species of ticks had more than one male to female ratio except *Rhipicephalus (Boophilus) decoloratus* (0.0097:1). There was no statistically significant association between hosts related factors and tick prevalence except for body condition score. Cattle with poor body condition have significantly ($p < 0.05$) higher tick burden than cattle with the other body condition scores. All tick species were distributed and attached with statistically significant ($p < 0.05$) variation among different parts of the host body, while all ticks inflict significantly diverse ($p < 0.05$) types of lesion except *A. variegatum*. Overall, the present study revealed very high prevalence of tick infestation that could potentially hamper the productivity of cattle in the study area, hence a serious measure should be put in place to control and reduce the adverse effect of tick infestation.

Key words: Bovine, identification, prevalence, ticks.

INTRODUCTION

Ticks were considered as parasites of domestic animals as early as 400 B.C. Aristotle in his famous historia animalium, stated that the ticks were disgusting parasites generated from grass. Despite this early realization, little work was done until the latter half of nineteenth century, when a number of parasitologists all over the world started working on taxonomy, prevalence, and bionomics, seasonal and regional occurrence of the ticks (Dobbelarece and Heussler, 1999). Ticks are obligate blood feeding ectoparasites of vertebrates; particularly mammals, birds and reptiles throughout the world (Rajput et al., 2006). They are cosmopolitan in distribution, but occur principally in tropical and subtropical regions with warm and humid climate which are suitable to undergo

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metamorphosis (Kilpatrick et al., 2007).

There are two well established families of ticks, the ixodidae (hard tick) and the argasidae (soft ticks). Of the ixoidae families, *Dermacntor, Rhipicephalus, Heamaphysalis, Boophlius, Ambylomma, Hyalomma, and Aponomma* genera have a great veterinary importance (Wall and shearer, 2001; Walker et al., 2003). Over 79 different species are found in Eastern Africa but many of these appear to be of little or no economic importance. The highest impact on livestock health is caused by species belonging to only three genera, namely, *Amblyomma, Hyalomma and Rhipicephalus* (Cumming, 1999).

Ethiopia has the largest livestock population in Africa that contributes to 40% of agricultural output/GDP in Ethiopia (CSA, 2013). Even though the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. Ectoparasites are one of the most important constraints that directly or indirectly affect the socio-economic development of poor farmers (Bekele, 2002). Ectoparasites in ruminant causes serious economic loss to small holder farmers, the tanning industry and the country as a whole through mortality of animals, decreased production, down grading and rejection of skin and hide (Tikit and Addis, 2011).

Ticks infestation is severe in different parts of Ethiopia and at a conservative estimate, one million USD is lost annually only through rejection of downgraded hides and skins attributed to tick damage (Gashaw, 2005). Bekele (2002), estimated that an annual loss of USD 5000,000 from hide and skin downgrading from ticks, and approximately 65.5% of major defects of hide in eastern Ethiopia were from ticks. Even though losses due to tick infestation is considerable in Ethiopia, and a number of researchers reported the distribution and abundance of tick species in different parts of the country, there is no work done in estimating the prevalence and distribution of ticks in Bedele district.

Therefore, the current study was conducted with the objectives of estimating the prevalence and identification of ixiodid ticks with respect to host related variables in Bedele district.

MATERIALS AND METHODS

Study area description

The study was conducted in Bedele district which is located in western Oromia regional state on a distance of 483 km to the west of Addis Ababa. Geographically, Bedele falls between 36° to 28° 80° N latitudes and 36° to 20°79°N longitudes. The total land area covers 1140.57km^2 with the altitude of 1400 to 2010 m above sea level. The annual mean temperature ranges from 12.5 to 27.5°C, and receives the annual rainfall greater than 1400 mm. The farming system of the area is a mixed farming system where 87% of the total population is engaged in agriculture. The livestock population is estimated to be 59,233 cattle, 40,543 sheep, 9,378 goats, 38,386 poultries and 1,878 equines of livestock populations (BWAB, 2006).

Study design and study animals

A cross-sectional study design was implemented from November, 2014 to April, 2015 to determine the prevalence of ixodid tick infestation and associated effect in bovines in Bedele district. The study population consists of cattle managed under extensive, semi intensive and intensive management system which constitute exotic, cross and local breeds.

Sample size determination and sampling method

The sample size was determined by assuming the expected prevalence of 50% tick infestation. The desired sample for the study was calculated by setting 95% confidence interval at 5% absolute precision (Thrusfield, 2007).Therefore, sample size of 384 cattle were examined in the study. Areas in the district were selected purposively according to accessibility and the cattle within the selected areas were selected and examined randomly from the household.

Study methodology

The host related factors like age and body condition were classified into groups for the convenience of the study. The age of the cattle were grouped into young (1 to 2 year), adult (3 to 7 years) and old (> 8 years) according to Gatenby (1991). While body condition score were grouped into poor, medium and good according to Nicholson and Butterworth (1986) after some modification.

Tick collection and preservation

The entire body surface of the animals was inspected for the presence or absence of ticks, and half body tick collections on alternative sides were made. Adult ticks were collected from different parts of body regions; dewlap, axillae, udder, groin, shoulders, hump, back, belly, flank, perineum, vulva, anus, under tail, scrotum, teat, prepuce, hind leg and sternum of animals after being restrained using physical handling. Date of collections, address, sites of attachment, associated lesion, breed, age, sex, body condition score and management system of animals were registered.

In addition, lesion inflicted on the animals due to tick infestation was recorded during the study. Ticks were removed from the host skin whilst retaining their good condition for identification using hand manually (Wall and Shearer, 2001). The collected ticks from each body regions were preserved in separate pre-filled universal bottles with 70% ethyl alcohol before transportation to parasitology laboratory for identification.

Laboratory examination for tick identification

The collected ticks were identified using stereomicroscope and classified to different genera levels based on size, mouthparts, colour of the body, leg colour, presence and absence of the eye. Furthermore, different morphology tick such as shape of scutum, leg colour, body, coxae one, festoon and ventral plates were considered for species level identification according to Walker et al. (2003).

Data analysis

The collected data was entered into Microsoft excel spread sheet and it was transferred to statistical package for the social sciences

Table 1. Prevalence of ticks and of percentage tick species from the collected ticks.

Tick species	No. of infested animals	Prevalence (%)	Total no. of collected ticks	Percentage of total ticks
A.cohaerens	159	41.5	1030	51.91
B.decoloratus	124	32.3	620	31.25
R.evertsievertsi	52	13.5	236	11.98
A.variegatum	25	6.5	98	4.9
Total	315	82	1984	100

Table 2. Identified tick species count and sex ratio.

Tick species	Sex		Male to Female Ratio
	Male count (no.)	Female count (no.)	
A. cohaerens	634	396	1.6:1
B. decoloratus	6	614	0.0097:1
Rh. evertsi evertsi	142	94	1.5:1
A. variegatum	62	36	1.7:1
Total	844	1140	-

Table 3. Number of infested animal and prevalence of tick species with respect to breed and management system of bovine.

Tick species	Breed			χ^2(p)	Management			χ^2(p)
						Semi		
	Local no. (%)	Cross no. (%)	Exotic no. (%)		Extensive no. (%)	Intensive no. (%)	Intensive no. (%)	
A.cohaerens	152 (39.7)	6 (1.6)	1 (0.3)	1.83 (0.4)	154 (40.2)	4 (1.0)	1 (0.3)	2.2 (0.33)
B.decoloratus	113 (29.4)	7 (1.8)	4 (1)	5.52 (0.06)	113 (30.7)	5 (1.3)	6 (1.6)	11.7 (0.3)
Rh.evertsi evertsi	51 (13.3)	1 (0.3)	-	2.01 (0.36)	52 (13.5)	-	-	2.61 (0.27)
A.variegatum	24 (6.2)	1 (0.3)	-	0.41 (0.81)	24 (6.2)	1 (0.3)	-	0.8 (0.67)
Total	340 (88.6)	15 (4)	5 (1.3)	-	343 (90.6)	10 (2.6)	7 (1.9)	-

(SPSS) version 20 for analysis. Association between explanatory variables (breed, sex, age, body condition score and management system) and outcome variable (tick infestation) was done using chi-square (X^2) test and percent values. In all analysis, all statistics were considered as significant at $p < 0.05$, while the confidence interval was set at 95% and 5% error probability.

RESULTS

The overall prevalence of ticks in the study area was 315 (82%) including single and mixed infestation (Table 1). Four ixodidae tick species were identified from the study area which belong to *Amblyomma* (Figure 1a, b, c and d) and *Rhipicephalus* (Figure 1e, f and g) genera of ticks. *Ambloyomma cohaerens* was the predominant tick species which was collected (1030 in number with 41.5% prevalence), while *Ambloyomma varigatum* was the least prevalent tick (98 in number with 6.5% prevalence) (Table 1). In the present study, male to female sex ratio for tick species indicated higher number of males than females for all species of tick except *Rhipicephalus (Boophilus) decoloratus* which had (0.0097:1) ratio of male to female tick (Table 2). Regarding the host related factors in the study, there was no statistically significant variation ($P > 0.05$) in prevalence of ticks between the breed, sex, age and management system of the cattle production (Table 3, 4). On the other hand, poorly conditioned animals were significantly ($p < 0.05$) infested more than the other groups in each species of identified ticks (Table 4).

In this study, tick species attachment site was investigated. *A. cohaerens* mostly tend to attach to genital area (scrotum/prepuce/premium/vulva) (14.9%), *A. variegatum* to groin/hind leg (7.9%), *R. (Boophilus) decoloratus* to dewlap (14.7%) and *Rhipicephalus evertsi evertsi* to anal region (anus/under tail) (14.9%). There

Figure 1. (a) Pictures of identified tick species. *Amblyomma cohaerens* male (dorsal and ventral side), (b) Amblyomma cohaerens female (dorsal and ventral side), **(c)** *Amblyomma variegatum* male (dorsal and ventral side), **(d)** *Amblyomma variegatum* female (dorsal and ventral side), **(e)** *Rhipicephalus evertesi evertesi* male (dorsal and ventral side), **(f)** *Rhipicephalus evertesi evertesi* female (dorsal and ventral side), **(g)** *Rhipicephalus (Boophilus) decoloratus* females (dorsal and ventral side side).

was statistical significant difference between all tick species and attachment site of ticks to host ($p < 0.05$) (Table 5). Concerning tick inflicted lesions on the cattle, *A. cohaerens* (35.0%) was the dominant tick species which inflict bite mark followed by *R. evertsi evertsi* (14.1%), while *R. (Boophilus) decoloratus* (6.3%) was the leading tick species in inflicting dermatitis followed by *A. cohaerens* (3.9%). Abscessation, inflamation, skin keratinization and focal hemorrhage were dominantly inflicted by *Amblyomma*. There was statistically significant association ($p < 0.05$) between the lesion inflicted and tick species infestation except for *A. variegatum* ($p > 0.05$) (Table 6).

DISCUSSION

In present study, there was high prevalence (82%) of tick infestation. This finding is in agreement with the reports of Alemu et al. (2014) with overall prevalence of 81.5%. However, the prevalence of ticks in the current study is greater than the reports of Gedilu et al. (2014), Tadesse and Sultan (2014) and Abdisa (2012) who reported prevalence of tick infestation with overall prevalence of

Table 4. Number of infested animal and prevalence of tick species in relation to sex, age and body condition score of bovine.

Tick species	Sex		Age			BCS		
	Female No. (%)	Male No. (%)	Young No. (%)	Adult No. (%)	Old No. (%)	Poor No. (%)	Medium No. (%)	Good No. (%)
A. cohaerens	91 (23.8)	68 (17.8)	51 (13.3)	82 (21.4)	26 (6.8)	81 (21.1)	63 (16.4)	15 (3.9)
χ^2 (p-value)	0.110 (0.740)			0.27 (0.893)			7.37 (0.02)	
B. decoloratus	70 (18.2)	54 (14.1)	40 (10.4)	67 (34.5)	17 (4.4)	50 (13)	48 (12.5)	26 (6.8)
χ^2 (p-value)	0.19 (0.65)			5.52 (0.06)			7.9 (0.02)	
Rh. evertsi evertsi	30 (7.8)	22 (5.7)	14 (3.6)	27 (7.0)	11 (2.9)	27 (7.0)	21 (5.5)	4 (1.0)
χ^2 (p-value)	0.004 (0.95)			1.69 (0.42)			3.05 (0.02)	
A. variegatum	12 (3.1)	13 (3.4)	10 (2.6)	13 (3.4)	2 (0.5)	10 (2.6)	13 (3.4)	2 (0.5)
χ^2 (p-value)	1.11 (0.29)			1.46 (0.48)			4.713 (0.09)	
Total	203 (52.9)	157 (41)	125 (29.9)	189 (66.3)	56 (14.6)	168 (43.7)	145 (37.8)	47 (12.2)

Table 5. Number of affected animal and tick prevalence in relation to attachment site on the host.

Tick species	Bite mark no. (%)	Dermatitis no. (%)	Abscessation no. (%)	Inflammation no. (%)	Skin keratinization no. (%)	Focal hemorrhage no. (%)	χ^2(p)
A. cohaerens	72 (35.0)	8 (3.9)	11 (5.3)	19 (9.2)	10 (4.9)	37 (18.0)	13.1 (0.022)
B. decoloratus	-	13 (6.3)	-	3 (1.5)	3 (1.5)	-	137.7 (0.00)
R. evertsi evertsi	29 (14.1)	-	4 (1.9)	12 (5.8)	-	2 (1.0)	19.7 (0.00)
A. variegatum	10 (4.9)	-	-	4 (1.9)	2 (1.0)	9 (4.4)	7.3 (0.199)
Total	111 (54.0)	21 (10.2)	15 (7.2)	36 (18.4)	15 (7.4)	48 (23.4)	-

Table 6. Number of affected animals and tick prevalence in relation to lesions inflicted by ticks.

Tick species	Attachment sites									χ^2(p)
	Face no. (%)	Dewlap no. (%)	Neck/shoulder/ hump no. (%)	Belly/flank/ back no. (%)	Scrotum/perineum/ prepuce/vulva no. (%)	Anus/under tail no. (%)	Axillae/ sternum no. (%)	Groin/hind leg no. (%)	Udder/ teat no. (%)	
Ambloyomm. cohaerens	-	16 (5.1)	1 (0.3)	-	47 (14.9)	17 (5.4)	11 (3.5)	21 (6.7)	46(14.6)	181.1 (0.0)
Rh.(Booph) decoloratus	10 (3.2)	47 (14.9)	28 (8.9)	28 (8.9)	4 (1.3)	3 (1.0)	-	-	3 (1.0)	238.1 (0.0)
Rh. evertsi evertsi	-	-	-	-	5 (1.3)	47 (14.9)	-	-	-	226.3 (0.0)
Ambloyomm. variegatum	-	2 (0.6%)	-	-	7 (2.2)	1 (0.3)	6 (1.9)	1 (0.3)	8 (7.9)	43.5 (0.0)

74, 59.4 and 53.2%, respectively.

In addition, various researcher works has proven to find less prevalence of tick infestation than the present study including the reports of Addis (2011) and Onu and Shiferaw (2013) who indicated tick prevalence of 25.64 and 14.5%, respectively. This difference could be due to the difference in the agro climatic condition of the study areas, since tick activity was influenced by rainfall,altitude and atmospheric relative humidity according to Pegram et al. (1981).

A. cohaerens was found to be the most abundant tick species with prevalence of 41.5 and 51.86% of total tick collected in the present study (Table 1). Likewise, Belay (2004) had reported high prevalence of *A. cohaerens* (50.5%). On the contrary, Gedilu et al. (2014), Huruma et al. (2015), Alemu et al. (2014) and Abdisa (2012) had reported *A. cohaerens* as the least prevalent tick species with a prevalence of 0.20, 2.4, 5.21 and 7.73% in their respective study. This can be attributed to the great susceptibility of *A. cohaerens* for losses of total body water which ultimately make it to perish rapidly when the humid protection is disrupted according to Gashaw (2005).

On the other hands, *R. (Boophilus) decoloratus* was the second most abundant tick species in the present study with prevalence of 32.3% (Table 1), which is in line with the findings of Alemu et al. (2014), Gedilu et al. (2014) and Bedaso et al. (2014) who reported *Boophilus decoloratus* as the most abundant tick with respective prevalence of 40.86, 47.93 and 26.3%, respectively. This might be due to *B. decoloratus* been abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually according to Pegram et al. (1981). *R. evertsi evertsi* was the third most abundant tick species in the present study area with prevalence of 13.5% (Table 1), which agrees with reports of Alemu et al. (2014) with prevalence of 11.51%.

In another research, *R. evertsi evertsi* was the second most abundant tick species with prevalence of 50.9% according to Abdisa (2012) and it was the most abundant tick species with prevalence of 53.4% according to Huruma et al. (2015) finding. On the other hand, *A. variegatum* was the least abundant tick species in the present study area with prevalence of 6.5% (Table 1), which agrees with reports of Onu and Shiferaw (2013) with prevalence of 4.7% and Abebe et al. (2010) with prevalence of 4.2%. However, the findings of Tadesse and Sultan (2014), Bedaso et al. (2014) and Addis(2011) were greater than the current finding with prevalence of 32.2, 41 and 45.49%, respectively.

The current study indicates that the numbers of male ticks were higher than the number of females except in *R. (Boophilus) decolaratus* in which the number of females are higher than female ticks (Table 2). This finding was in agreement with the report of Abdisa (2012) and Bedaso et al. (2014) who reported the similar trend. This might be attributed to the fact that male ticks take less food than females but remain longer on the host and can mate with several females. Furthermore, the observed female outnumbering of male ticks in *B. decolaratus* in the current study might be due to the small size of male tick which may not be seen during collection according to Huruma et al. (2015) who reported the same result.

In the current study, animals with poor body condition were highly infested ($p < 0.05$) than the other body condition groups by each species of the ticks (Table 4). This finding is in line with the work of Bilkis et al. (2011) and Wolde and Mohamed (2014) who reported cattle with poor body condition were significantly ($P < 0.05$) infested more than that of cattle with normal body condition. This may be due to the fact that poorly conditioned animals were least resistant to tick infestation and lack enough body potential to build resistance whereas over-conditioned animals showed reasonable combat to the infestation according to Manan et al. (2007). Alternatively, tick infestation might be a cause for poor body condition; hence high prevalence was computed in this group of animals.

Regarding the attachment site of the ticks, there was statistically significant ($p < 0.05$) difference in attachment site on host in present study (Table 5). The predilection sites found in this study corroborate with those reported by Wolde and Mohamed (2014) at southern part of Ethiopia. Specifically, Kabir et al. (2011) at Bangladesh also reported that hard tick infestation on groin and mammary glands was most prevalent in cattle (48.75%), whereas lowest in face and neck region (30.0%) which is almost in line with present finding. In fact, Stachurski (2000) states that short hypostome ticks like *Ripicephalus* usually prefer upper body parts including nape of neck and margin of anus and under tail while long hypostome ticks like *Ambloyomma* attaches to lower parts of the animal body, which is also the case in the present study.

In the present study, there was statistically significant association ($p < 0.05$) between the lesion inflicted and specific tick species infestation except for *A. variegatum* ($p > 0.05$) (Table 6). *R. (Boophilus) decoloratus* (6.3%) was the leading tick species in inflicting dermatitis while *A. cohaerens and A. variegatum* was the most important tick species to inflict the bite mark (wound) and focal hemorrhage in the present study (Table 6). This was probably due to their long mouth part that results in severe bite according to Gebre et al. (2001) and Gashaw (2005).

Conclusion

The present study revealed high prevalence of ixodid tick infestation in the study area. These pose huge economical and health constraint to the farmers and the animals in the study area. The direct pathological lesion encountered during the study support the effect of tick infestation on the skin condition of the animals which can be reflected on the tannery industry as a whole. Therefore, systematic intervention and control of tick infestation should be put in place to tackle the diseases.

Conflicts of interest

Authors have none to declare.

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