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The Prevalence and Associated Risk Factors of Tick Infestation On Cattle in Selected Kebeles of Arsi Negelle, Oromia Region, Ethiopia

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Keywords

Arsi-Negelle,
Cattle,
Prevalence,
Risk Factor,
Tick.

Abstract

This study was conducted from November 2013 to April 2014 in five kebeles selected from Arsi-Negelleworeda. The aims of this study were to determine the prevalence of tick infestation and the associated risk factors and to identify the major tick species infesting cattle. Out of the total 500 cattle examined, 256 (51.2%) were found to be infested byone or more types of tick species. During the study period, a total of 2946 ticks were collected of which1768 (60%) were male and 1178 (40%) were female. The overall mean tick burden was 11.5±7.71 and the count ranges from 2 to 44. Four species of ticks which belong to three genera were identified. These, in order of abundance are *Amblyomma variegatum* (35.4%), *Amblyomma gemma* (25.9%), *Rhipicephalus decoloratus* (25.4%) and *Rhipicephalus evertsievertsi* (13.2%).There was no significant($P> 0.05$) difference in the prevalence of tick infestation and mean tick burden between the five kebeles included in the study showing that the areas have similar agro-ecological conditions. The mean tick burden was significantly higher ($P < 0.001$) in adult animals (14.2±8.8) than young animals (9.9±6) and calves (9.4±6.6). Similarly, the mean tick burden was significantly higher ($P< 0.001$) in female animals (13.5±8.4) than male (10.1±6.9).There was also a significant difference ($P< 0.001$) in mean tick burden between the different body regions. Among the body regions of cattle, significantly higher mean tick burdens were collected from udder and axial regions than other body parts ($P< 0.001$). In contrast, factors like breed, study area and body condition score did not show any significant association with mean tick burden ($P> 0.05$ for each factor). In conclusion, the prevalence and mean tick burden observed in the current study are substantial that warrant the need for strategic acaricides application based on the biology of the tick species encountered and special emphasis should be given to adult and female cattle which are at higher risk of infestation.

Introduction

Ethiopia is one of the most populous countries in Africa, having an estimated population of more than 80 million people. This growing population demands much better economic performance than in the past, at least to ensure food security and other basic needs [1]. The agricultural sector plays a pivotal role in national economy, livelihood and socio-cultural system. The sector supports employment of over 80% of the population, accounts for about 45%of the National Gross Domestic Product (GDP) and makes the largest contribution to raw materials for agro-industries, most domestic food requirements, and contributing to 80% of foreign exchange earnings [2]. The livestock sub-sector contributes 16% of the total GDP and over 30% of the agricultural GDP [3].

Diseases of various ecological origins are among the numerous factors responsible for poor production and productivity. Parasitic diseases are a global problem and considered as a major obstacle in the health and product performance of livestock. Ticks are very significant and harmful blood sucking external parasites of mammals, birds and reptiles throughout the world [4]. Ticks are effective disease vectors, second only to mosquitoes in transmitting infectious diseases [5]. Major cattle tick borne diseases in Ethiopia are anaplasmosis, babesiosis, theileriosis [6] and streptothricosis [7]. Besides to disease transmission, ticks inflict a huge economic loss. Production losses due to ticks and tick borne diseases (TTBDs) around the globe have been estimated at US $13.9 to US $18.7 billion annually leaving world's 80% cattle at risk [8-10]. In Ethiopia[11] estimated an annual loss of US $ 500,000 from hides and skin downgrading from ticks and approximately 65.5% of major defects of hides in eastern Ethiopia are from ticks.

Over 79 different species of ticks are found in eastern Africa and many of these appear to be of little or no economic importance [12]. In Ethiopia, ticks are common in all agro-ecological zones [13]. According to Bayu[14] 47 species of ticks are found on livestock in the country. The genus *Amblyomma* and *Rhipicephalus* including *Boophulus* formerly ticks are predominating in many parts of the country, *Hyalomma* ticks also have a significant role [15]. *Amblyommacohaerence*is prevalent and abundant in western humid highland areas of Ethiopia. *Rhipicephalus decolaratus* and *Rhipicephalus evertsievertsi* are widely distributed in most altitudinal ranges [16]. Due to economic and veterinary importance of ticks, their control and the transmission of tick borne diseases remain a challenge for the cattle industry in tropical and sub-tropical areas of the world and it is a priority for many countries in tropical and sub-tropical regions [17]. In spite of the huge economic and veterinary impact of ticks, studies on the distribution and burden of ticks are not undertaken in all woredas of the country including the current study area.

Therefore, the objective of the study was:

To estimate the prevalence of tick infestation in cattle in Arsi-Negelle woreda
To determine the genus and species of ticks prevalent and the preferred predilection sites by the ticks in the study area
To assess the tick burden between breed groups, body parts, sex groups, age groupsand body condition scores in the study area.

Materials and Methods

Study area

The present study was conducted starting from November 2013 to April 2014 on randomly selected five kebeles in Arsi-Negelleworeda. The kebeles included in the study were Arsi-Negelle town, Alliwoyo, Seyomeja, Kersa and Gambelto. Arsi-Negelleworeda is located around 200km away from Addis Ababa and found in west Arsi zone of Oromiya regional state at an altitude of 1500-2018 m.a.s.l. The area is known by having two agro climatic zones, woynadega (68%) and kola (28%). The annual rain fall ranges from 500-1000mm [18].

Study design

For this particular study a cross-sectional study was conducted on local and cross breed cattle found in Arsi-Negelleworeda to identify the major ticks, their predilection sites and tick burden in different age groups, breeds, body condition scores, sex of animals and different areas in the woreda.

Study population

The study animals were cattle of any age, sex, breed groups and body condition scores found in the randomly selected kebeles of Arsi-Negelleworeda. It is

estimated that a total of more than 379,645 cattle are found in ArsiNegelleworeda. The study included all age groups of animals: calves, young and adults.

Sample size and sampling method

The sampling method employed to select the study animals was simple random sampling method. The total number of cattle required for the study was calculated based on the formula described by Thrusfield [19] for random sampling method. Since there was no any study on tick infestation in Arsi-Negelleworeda previously, it was possible to use 50% expected prevalence. The absolute precision was taken as 5% with 95% level of confidence. According to the formula given by Thrusfield[19]:

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

Where;
n = number of sample (Sample size required)
P_{exp}= minimum expected prevalence=50%
d = desired precision=5%
1.96 = the value of Z at 95% confidence interval

$$n=\frac{1.96^2 \times 0.5\ (1-0.5)}{0.05^2}$$

n = 384

Therefore, the number of cattle required for the study is 384.

Here, even though 384 animals were thought to be examined, the number of animals examined was increased to 500 to increase the precision of the study.

Study methodology

Age and body condition score determination

Tick infestation was considered in adult, young and calf age groups. The age of the animal was determined by asking the owner of the animal. The body condition score was determined by observing the anatomical parts of the animal like tail-head, brisket and hump, transvers process of lumbar vertebrates and ribs as well as hips [20]. The body condition of most animals was moderate and some of them were fat and lean.

Tick collection, identification and count

Once after the selected animal was restrained, the entire body surface of the animal was examined thoroughly and all visible adult ticks were collected from half-body on alternative sides. Ticks were removed carefully and gently in a horizontal pull to the body surface. The collected ticks were preserved in universal bottles containing 70% ethyl alcohol and labeled with the animal identification and predilection site [21]. The specimens were then transported to the Parasitology laboratory of the School of Veterinary Medicine of Hawassa University for counting and identification. The parts of the animal from which ticks were removed are dewlap, sternum, udder, axial region, scrotum, belly and, perineum, vulva and under tail. The ticks were then counted and subsequently identified to sex; genus and species level using stereomicroscope according to standard identification keys given by Walker[21]. The half-body tick counts of cattle were doubled to obtain the whole body tick burdens.

During examination of the selected animals for tick infestation, the age, sex, body condition score (BCS), breedand kebele of the sampled animals were recorded on a special format designed for this purpose. During the study, distribution of ticks and total count of each tick species were done. In addition to this, major tick species and their distribution in different localities of the study area was performed. Moreover, distribution of ticks in different body parts of the animal was also done. Sex ratio of major tick species in the study area was considered. Furthermore, tick burden within group of sex, breed, age, localities and body condition scores was done.

Data analysis

The data obtained from the study animals and laboratory identification of ticks were uploaded into Microsoft Excel spreadsheet and summarized by using tables. All the statistical analyses were performed on SPSS 16.0 for windows software. Descriptive statistics like mean and percentages were calculated to display the status of ticks in relation to some considered variables. The association of mean tick burden with the study variables was analyzed by using one-way analysis of variance (ANOVA).The difference in prevalence of ticks between kebeles was analyzed by using Pearson's chi-square test.

Results

Prevalence of tick infestation

Out of the total 500 cattle examined, 256 (51.2%) were found to be infested by one or more species of ticks. There was no significant ($P > 0.05$) difference in the prevalence of tick infestation between the different study areas in the woreda (Table 1)

Table 1. Prevalence of tick infestation in Arsi-Negelle woreda based on study area

Study area	No of Animals examined	No of Animals infested	Prevalence (%)	χ^2	*P*
Arsi Town	90	57	63.3		
Alliwoyo	139	63	46.3		
Gambelto	62	33	53.2		
Kersa	147	72	49.0		
Seyomeja	62	31	50.0		
Total	500	256	51.2	7.65	0.105

Tick burden and species identification

During the study period, total 2946 adult ticks were collected from 256 cattle in five study areas (Kebeles). The mean tick burden of a single was 11.5 and the counts ranged from 2 to 44. Four different species of tick which belong to three genera were identified. The tick species encountered take account of *A.variegatum* (35.4%), *A.gemma* (25.9%), *R. decoloratus* (25.4%) and *R.evertsievertsi* (13.3%) in a diminishing hierarchy of overall abundance. From the total ticks collected, 1768 (60%) were male and 1178 (40%) were female (Table 2).

Table 2. Tick species identified and their burden based on their sex

Tick spp	Male	Female	Total	Proportion (%)
Amblyomma variegatum	690	352	1042	35.4
Amblyommagemma	564	200	764	25.9
Rhipicephalu decoloratus	194	554	748	25.4
Rhipicephalusevertsievertsi	320	92	392	13.3
Overall	1768	1178	2946	100

Variations in their attachment sites were observed when the tick species identified displayed on the body region of cattle. *A variegatum* and *R. decoloratus* were collected from all body regions; *A. gemma* was not detected in udder, scrotum, belly and PVU regions while *R.evertsievertsi* was not seen on sternum and belly (Table 3).

Table 3. Tick species identified and their burdenby body region

Body region	*A.variegatum*	*A.gemma*	*R.decoloratus*	*R.evertsievertsi*	Total
Dewlap	186	264	124	44	618
Sternum	202	242	120	-	564
Udder	174	-	84	80	338
Axial region	56	258	116	74	504
Scrotum	236	-	78	58	372
Belly	126	-	168	-	294
Perineum, vulva and under tail (PVU)	62	-	58	136	256
Total	1042	764	748	392	2946

Analysis of the mean tick burden between the body regions showed a significant (P< 0.001) difference. The mean tick burden was significantly higher in udder and axial region than other parts while the burden was the least in dewlap region (Table 4).

Table 4.Analysis of mean tick burden in cattle between body regions

Body region	Mean	SD	SE	95% CI for Mean	F	P
Dewlap	4.0	2.7	0.2	3.6 – 4.4		Rf
Belly	5.3	2.8	0.4	4.5 – 6.0		0.667
Sternum	7.7	6.0	0.7	6.3 – 9.1		0.000
Udder	8.7	4.1	0.7	7.3 - 10		0.000
Axial	8.7	4.2	0.6	7.6 – 9.8		0.000
Scrotum	5.2	2.6	0.3	4.6 – 5.9		0.432
PVU	6.6	3.8	0.6	5.3 – 7.8		0.002
Overall	11.5	7.7	0.5	10.6 – 12.5	21.2	0.000

Analysis of mean tick burden with different risk factors

The mean tick burden in cattle was analyzed with different host and environmental risk factors. It was found that the mean tick burden was significantly (P< 0.001) higher in adult cattle (> 3 year) than the middle age group (1-3 year) and the youngest animals (<1 year). Cattle <1 year of age had the least mean tick burden. Similarly, female cattle had significantly (P< 0.001) higher mean tick burden than male cattle. In contrast, breed, study area, and BCS were not significantly (P> 0.05 for each factor) associated with mean tick burden (Table 5)

Table 4. Analysis of mean tick burden in cattle with different risk factors

Risk factors	N	Mean	SD	95% CI for mean	F	P
Age						
• ≤ 1 year	85	9.4	6.6	8.0 – 10.9		Rf
• 1-3 year	67	9.9	6.0	8.4 – 11.4		1.000
• >3 year	104	14.2	8.8	12.5 – 15.9	11.699	0.000
Sex						
• Male	147	10.1	6.9	8.9 – 11.2		
• Female	109	13.5	8.4	11.9 – 15.0	12.518	0.000
Breed						
• Cross	3	12.0	4.0	2.1 – 21.9		
• Local	253	11.5	7.8	10.5 – 12.5	0.012	0.912
Study area						
• Arsi town	57	9.9	6.7	8.1 – 11.7		
• Alliwoyo	63	13.1	7.2	11.3 – 14.9		
• Seyomeja	31	11.2	7.6	8.4 – 13.9		
• Gambelto	33	9.7	7.7	7.0 – 12.4		
• Kersa	72	12.3	8.7	10.3 – 14.4	1.98	0.099
BCS						
• Lean	12	13.17	8.9	7.5 – 18.8		
• Moderate	244	11.43	7.7	10.5 – 12.4	0.579	0.447
• Fat	13	-	-	-		

Discussion

In the current study, prevalence of tick infestation was found to be 51.2%in cattle which is lower than previous report in South Wollo region of Ethiopia which was 90 % [22]. The different in the prevalence of infestation might be due to agro-ecological difference, season of the study period and breed different of the study animals.

The problem of tick infestation in cattle of the study area seems to be very important as they are widely distributed in all selected kebeles in the study area and affecting all age groups and both sexes. The current study has shown that almost half of cattle examined were infested by different species of ticks. The finding of such level of infestation in a season more or less said to be dry indicates the presence of suitable ecological conditions for the survival and breeding of ticks in the study area and also it may be due to poor level of awareness of cattle owners to regularly treat their cattle with appropriate acaricides. It has been stated that high humidity facilitates the growth and survival of ticks at all their different life stages [23, 24]. In addition to this, concentration of host species for each of the developmental instars to locate a new host must be satisfied as main requirement in the tick habitat [23].

The principal tick species infesting cattle in the study area were *A.variegatum,A.gemma, R.decoloratus* and *R.evertsievertsi* in decreasing order of abundance.*A.variegatum* was the most abundant tick in the study area accounted for 35.4% of the total tick count. It was collected from all body regions of the animals. This species, commonly known by its name tropical bont tick, is widely distributed in Ethiopia [25]. The result of this study comparable with tick survey conducted at Bako district in Western Shawa that indicated the distribution of this tick species as the first most abundant species in that area with a prevalence of 54.3% [26]. It was reported that *A. variegatum* is the most common and widely distributed cattle tick in Ethiopia [13,27,28]. It has a great economic importance, because it isan efficient vector of *Cowderiaruminatum*(*Eimeriabovis*)and causes greatest damage to hide, due to its long mouth parts, and reducesits value on world market[29].

Amblyomma gemma was the second abundant tick species in the study area with mean burden value next to *A.variegatum*and accounted for 25.9% of the total tick count in the study area. In the present study, this tick had preference to dewlap, sternum and axial egions only. This tick has been recorded from areas with climates ranging from temperate (High land) through steppe to desert. Morel[27] stated that *A. gemmais*widely distributed in Ethiopia in woodland, bush land, wooded and grassland in arid and semi-arid area between altitude 500 to 1750 m above sea level and receiving 350 to 750 mm annual rain fall.

Rhipicephalus decoloratus was the third abundant tick species next to *A.gemma*and accounted for 25.4% of the total tick count. As with*A. variegatum*, this tick species was also collected from all body regions of cattle. This tick is indigenous to Africa and most evolved as a parasite of ungulates in East Africa [30]. This species is reported to be widely distributed in the central Rift valley parts of Ethiopia [13, 15]it is the commonest and most widespread tick in Ethiopia collected from all regions except Afar.

R.evertsievertsi was the least abundant tick in the study area which accounted for only 13.3% of the total tick count. This tick is widely distributed in Ethiopia and requires moisture and warmth for its survival and it is not found in open grass land. The preferred hosts of adult stage are cattle [13]. The current finding is comparable with the findings of Solomon*et al*. [29] who reported 14.14%[31] described its wide distribution throughout the Ethiopian faunal region. [13] reported that this species had not showed specific preference for a particular altitude, rainfall zones or seasons; and it is also known to convey tick paralysis in Harar Ethiopia [27].

In this study, a total of 2946 ticks of different species were collected from all body regions of which 1768 (60%) were male and 1178 (40%) were female ticks. The overall mean tick burden was 11.5±7.71 and the count ranges from 2 to 44. The total tick count and mean tick burden observed in the current study is considerably lower than the findings of previous studies in the country [32,33]. The variations in mean tick burden between the current and previous studies might be attributed to differences in the climatic conditions, season, method of sampling and number of animals used for the study. In all species, except *B. decoloratus*, the number of female ticks was lower than male ticks. This is due to the fact that fully engorged female tick drop off to the ground to lay eggs while male tend to remain permanently attached to the host up to several months later to continue feeding and mating with other females on the host before dropping off and hence males normally remains on the host longer than female [15, 34]. In agreement with the present study other researchers in Ethiopia

have also reported a significantly higher proportion of male ticks than females for most ticks species while a higher female to male ratio for *R. decoloratus*[32, 33]. The increase in female to male ratio of *R.decoloratus* might be as suggested by Kaiser [34]due to small size of males which creates difficulty of finding it.

There was a significant difference ($P< 0.001$) in mean tick burden between the different body regions. Relatively largest mean burden were recorded in axial (8.69±4.21) and udder (8.67±4.11) regions. The observation of larger burden of ticks in these body regions may be due to the fact that they are so closer to the ground that ticks from the environment can easily climb up and attach.

In this study, age and sex of the host were the two factors found to be significantly ($P< 0.001$) associated with mean tick burden in cattle. The other hypothesized risk factors such as breed, study area and BCS were not significantly ($P> 0.05$ for each factor) associated with mean tick burden. The mean tick burden was significantly ($P< 0.001$) lower in the youngest animals (9.4±6.6) than middle age (9.9±6.0) and adult animals (14.2±8.8). There was steady increase in mean tick burden with age. In contrast to the present finding,Kaiser*et al*. [32] reported previously lack of significant difference between male and female and among the different age groups.

There was lack of significant difference in prevalence and mean tick burden between the different study areas covered by the present study may be due to the fact that the areas have similar agro-ecological conditions, which are conducive for the survival and breeding of the developmental stages of ticks.

Conclusion and Summary

In conclusion, this study has shown the existence of economically important tick species namely, *Amllyom mavarigatum, Amblyom magemma*. *Rhipicephalus* and *Rhipicephalus evertsievertsi* with considerable abundance in the current study area. Among the risk factors observed age and sex were the two variables found to be significantly influencing the mean tick burden in the study area. Young animals <1 year were the most susceptible animals for tick infestation. In contrast, variations in study area, breedand body condition score did not have significant effect on the mean tick burden.

Regarding the distribution of ticks in different parts of the body, this study has revealed the highest mean tick burden on axial and udder regions of the study animals while the least burden was recorded in dewlap. Furthermore, the study has shown that *A. vaiegatum* and *R. decoloratus* had no preference to certain predilection sites and they were distributed in all parts of the body while *A. gemma*was collected only from dewlap, sternum and axial region. *Rhipicephalusevertsievertsi*was not found in sternum and belly regions.

Based on the above conclusion the following recommendations are forwarded.

- Animals should be treated with appropriate acaricides
- Strategic dipping should also be applied
- Special attention should be given to those parts of the animal body which are highly infested by ticks during acaricide application
- People should be aware about the effect of tick infestation on their animals
- Whenever control measures are applied, especial emphasis should be given to adult and female cattle which are at higher risk of infestation

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References

1. Central statistical agency (CSA), 2008a. Agricultural sample Enumeration 2001-2002(1994 E.C) Livestock Central statistical Agency ofEthiopia (Ministry of Finance and Economic Development), September 2008a,AddisAbaba,Ethiopia.Retrieved 19th 320 February 2010 from http://www.csa.gov.et/nada1/ddibrowser.

2. Central Statistical Agency (CSA), 2007: Compilation of Economic Statistics in Ethiopia. Addis Ababa, Ethiopia, pp.1-10.
3. Asfaw,W., 1997. Country report: Ethiopia in: proceeding of seminar on livestock Development Policies in Eastern and Southern Africa, Mababany,organized by CTA,OAU,The Ministry of Agriculture, Cooperative,Swaziland.
4. Rajput. Z.I., C. Song- huaHu, G. Wan-jun, Abdillah and X. chen –wen, 2006: Review of Importance of tick and their chemical and immunological control in livestock,Journal of Zhejiang University Science,7:912-921.
5. Le Bars, C., 2009: Tick-borne disease management. Veterinary Times, 18th May.
6. Mekonnen, S., J. de Castro, S. Gebre, I. Hussein and A. Regassa, 1992: Ticks, tick-borne diseases and their control in Western Ethiopia. Int. J. Trop. Insect Sci., 13:661-664.
7. Mekonnen, S., 1996: Epidemiology of ticks and tick-borne diseases in Ethiopia: Future research need and priorities. In: Irvin A.D., McDermott J.J. and Perry B.D. (eds), Epidemiology of Ticks and Tickborne Diseases in Eastern, Central and Southern Africa. Proceedings of a Workshop Held in Harare, 12–13 March 1996. ILRI (International Livestock Research Institute), Nairobi, Kenya, 174 pp.
8. De Castro, J., 1997: Sustainable tick and tick borne disease control in livestock improvement in developing countries. Vet. Parasitol, 71:77- 97.
9. De Wall, D., 2000. Anaplasmosis control and diagnosis in South Africa. Ann. N. Y. Acad. Sci., 916:474-483.Ghosh, S.P., 2007: Azhahianambia and M. P. Yadav, Upcoming and future strategies of tick control: a review. J. Vector Borne Dis, 44:79- 89
10. Ghosh, S.P., 2007: Azhahianambia and M. P. Yadav, Upcoming and future strategies of tick control: a review. J. Vector Borne Dis., 44:79-89
11. Bekele, T., 2002: Studies on seasonal dynamics of ticks of Ogaden cattle and individual variation in resistance to ticks in Eastern Ethiopia. J. Vet. Med., 49: 285–288.
12. Cumming, G.S., 1999: Host distributions do not limit the species ranges of most African ticks. Acari: Ixodida Bull. Entomol.Res., 89: 303-327.
13. Pegram, G., H. Hoogsstraal and H. Wassef, 1981: Ticks Argasidae, Ixodidae of Ethiopia; Distribution, ecology and host relationship of species infecting livestock. Bull. Entomol. Res., 71:339-359.
14. Bayu, K., 2005: Standard veterinary laboratory diagnostic manual.Vol.III.MOA Addis Ababa.
15. Solomon, G., M. Nigist and B. Kassa, 2001: Seasonal Variation of Ticks on Calves at Sebata in Western ShoaZone. EthiopianVet. J.,7(1:2):17- 30.
16. Bekele, H., 1987: Study of the topographical distribution of tick on economically important domestic animals in Illubabor. DVM thesis, FVM, AAU, Debrezeit, Ethiopia.
17. Lodos, J.O., 2000: Boue and J. Fuente.Model to simulate the effect of vaccination against Boophilusticks on cattle. Vet. Parasitol, 87(4):315-326.
18. Central Statistics Authority (CSA), 1998. In Ethiopia livestock estimate,vol. I, Bulletin, No.52, Addis Ababa, Ethiopia.
19. Thrusfield, M., 2005: Veterinary Epidemology3rd ed. Black well science, UK., pp. 182-189.
20. VanNiekerk, A. and B.P. Louw,1980. Condition scoring of beef cattle. Bulletin N2/80, Department of Agriculture and Fisheries, Natal Region, South Africa.
21. Walker,A., A. Bouattour, J. camicas, P. Estrada, I. horak, A. Latif, R. Pegram and P. Preston, 2003. Ticks of domestic animals in Africa.In: a guide to identification of Species, Bio-science Report,Pp1-221.
22. Yilma, J. and W. Daniel and P. Dorchies, 1995. Survey of tick infestating domestic ruminants in south wollo regions of Ethiopia. Revue Med.Vet.,143(3): 213-220.
23. Wall, R. and D. Shearer, 2001: Veterinary Ectoparasites:Biology,Pathology and Control.2nd edition,Blackwell Science Ltd.UK.262p.
24. Taylor, M.A., R. Coop and R. Wall,2007. VeterinaryParasitlogy,Third edition. Blackwell Science limited, UK., 874p.
25. Sileshi,M., R. Pegram, G. Solomon, M. Abebe and J. Yilma and Z. Sileshi, 2007: A synthesis review of ixodid(Acari:Ixodidae) and argasid (Acari:Argasidae) ticks in Ethiopia and their possible roles in disease transmission, Ethiopian Veterinary Journal,11:1-24.

26. Husen, U., 2009: Survey of cattle tick species and tick burden in and around Bako town DVM thesis, College of Agriculture and Veterinary Medicine, Jimma University, Jimma, Ethiopia.
27. Morel, P., 1980: Study on Ethiopia ticks (Argasidae, Ixodidae) Republic of France, Ministry of foreign affairs, French Vet. Mission, Addis. C. J. E. V. T., 12:332.
28. Assefa, B., 2004: A survey of ticks and tick-borne blood protozoa in cattle at Assela,Arsi Zone. DVM thesis, FVM, AAU, Debrezeit, Ethiopia.
29. Solomon, G., M. Sileshi, M. Nigist, C. Thomas, T. Getachew and M. Abebe, 2007. Distribution and seasonal variation of ticks on cattle at GhibeTollay in central Ethiopia.Ethiopian Vet. J., 11: 121–139.
30. Walker, J., 1991. A review of the Ixodid ticks(Acari, Ixodidae) occurring in southern A frica,Ondersstepoort Journal of Veternariy Research,58: 81-105.
31. Hoogstral, H., 1956. African Ixodidae I. Ticks of the Sudan (with SpecialReference to Equatorial Province and with Preliminary Reviews of theGeneraBoophilus, MargaroupsandHyalomma). US GovernmentDepartment of Navy, Bureau of Medicine and Surgery, Washington, DC.
32. Abera, M., T. Mohammed, R. Abebe, K. Aragaw and J. Bekele, 2010: Survey of ixodid ticks in domestic ruminants in Bedelledistrict, Southwestern Ethiopia. Trop Anim Health Prod., 42:1677–1683.
33. Abebe,R., T. Fantahun, M. Abera and J. Bekele, 2010: Survey of ticks (Acari: Ixodidae) infesting cattle in two districts of Somali Regional State, Ethiopia.Veterinary World, 3(12):539-543
34. Kaiser, M., 1987: Report on Tick Taxonomy and Biology.AG;DP/ETH/83/023.Consultant Repotr.FAO.Rome, Italy.

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