



Science

PREVALENCE OF TICK INFESTATION ON SMALL RUMINANTS IN AND AROUND DIRE DAWA, EASTERN ETHIOPIA

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Abstract

Across section, study of tick was conducted to identify types of tick species and determine the Prevalence of tick infestation in small ruminants in and around Dire Dawa Administrative council, Eastern Ethiopia. Collection and identification of the ticks were undertaken from November 2014 to May 2015. The overall prevalence of tick infestation in the study area was 278 (72.39% /384). All visible individual adult ticks were collected from the body of 196 goats and 188 sheep. The prevalence of tick infestation in goats and sheep was found to be 73.9% and 70.7%, respectively. In this study, eight species of ticks, which grouped under four genera, were identified. The most abundant species found in this study were *Rhipicephalus pulchellus* (34.1%), *Amblyomma variegatum* (24.5%), *Rhipicephalus evertsievertsi* (22.1%), *Hyalomma truncatum* (15.6%), *Hyalomma marginatum rufipes* (12.2%) and *Amblyomma gemma* (10.9 according to predominance. *Hyalomma dromedari* (4.2%) and *Boophilus decoloratus* was the minor species observed on both goats and sheep in the study area. The difference in prevalence of tick infestation was found statistically significant variation ($P < 0.05$) between the sex, age exception of *Boophilus decoloratus* and *Hyalomma dromedari* in all cases male ticks dominated females.

Keywords: Dire Dawa; Eastern Ethiopia; Ixodid Tick; Small Ruminants; Prevalence.

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1. Introduction

Ethiopia has the largest number of livestock in Africa, approximately 44.3 million cattle, 46.9 million sheep and goats, more than 1.0 million camels, 4.5 million equine, and 40.0 million chickens [11]. Among livestock, small ruminants play a significant role in socio-economic life of the people of Ethiopia. Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep, and goats are considered as investments and insurance to provide income to purchase food during seasons of crop failure and to meet seasonal purchases such as improved seed, fertilizer, and medicine for rural households. Hides and skins accounts for 12-16% of the total value of exports in Ethiopia[53]. Ticks are obligate, blood feeding *ectoparasites* of vertebrates, particularly mammals and birds [28]. Ticks are most numerous, particularly in tropical and sub-tropical regions, and their impact on animal health and production is greatest in these regions [25]. Ticks are directly or indirectly involved in causing substantial financial losses to livestock industry of Ethiopia accounts for 75% of the animal exports. A conservative estimate of 1 million birr loss annually was made through rejection and downgrading of hides and skins in Ethiopia [54] and [10]. The current utilization of hides and skins in Ethiopia is estimated to be 45% for cattle hide, 75% goatskin, and 97% sheep skin with expected off take of 33, 35, and 7% for sheep, goats, and cattle, respectively. However, in recent years, this rank has been relegated to fifth level mainly because of rejection and down grading inflicted on hides and skin defects mainly due to infestation by external parasites [24] Ticks that are considered most important to domestic animals' health in Africa comprise about 7 genera and sixteen species[49]. In Ethiopia, there are 47 species of ticks found on livestock, most of them have importance as vector, and disease-causing agents, have damaging effect on skin, and hide production [9]. Tick bite may be directly debilitating to domestic animals, causing mechanical damage, irritation, inflammation, and hypersensitivity and, when present in large numbers, feeding may cause anemia and loss of production. Some species cause tick paralysis and the others will elaborate toxins other than those causing paralysis. Heavy tick burden cause sufficient worry to interfere with feeding which may lead to loss of production and weight gain [32]. Numerous studies have been conducted on tick and tick-borne diseases of ruminants in various parts of Ethiopia and several species of ticks belonging to genus *Amblyomma*, *Boophilus*, *Rhipicephalus*, *Hyalomma* and *Haemaphysalis* have been reported. Among these tick genera, the main ticks found in Ethiopia are *Amblyomma* (40%), *Boophilus* (21%), *Haemaphysalis* (0.5%), *Hyalomma* (1.5%), and *Rhipicephalus* (37%) [28] and [29]. Many studies on tick distribution, prevalence, species identification, effect on domestic animals and methods of prevention were done as compared to other important skin diseases of animals in Ethiopia. Both hard ticks (*Ixodidae*) and soft ticks (*Argasidae*) are known to affect small ruminants. Among these, *Amblyomma* species (*A.variegatum*, *A. coherence*, *A.gemma*, *A. lipidium*, *A. excavatum* and *A. hebraeum*) are known tick species identified. *A.variegatum*, *A. coherence* and *A.gemma* are the most prevalent species of the genus *Amblyomma* in order of importance respectively [2];[43]. *B. decoloratus* is also encountered in small ruminants [27] *Rhipicephalus* species [12]; [52], *Hyalomma* species [42] and *Haemaphysalis* species [10]; [12] were identified [7] also showed that these tick genera are frequently encountered in Ethiopia. [17] Indicated that tick has highest prevalence in Cheffe state farm, South Wollo [8] from three agro-ecological zones of southern rangeland of Ethiopia. Ticks are common in all agro-ecological zones of Ethiopia [31]. Even though different studies were done on camel ticks, cattle ticks and other domestic animals in the Eastern part of the country [19] little attention was given to ectoparasites small ruminants in the

study area. Moreover, there was not specific study conducted on status of tick infestation on small ruminant in Dire Dawa.

Therefore, this study was with aim to

- Determine the prevalence of tick infestation in small ruminants and
- Identify the types of tick species infesting small ruminants in the study area.

2. Materials and Methods

2.1. Study Area Description

The study was conducted in Dire Dawa town Dire Dawa Administrative Council, Eastern Ethiopia. It is situated about 510 km East of Addis Ababa. The rainfall pattern of the area is characterized by small rainy season from February to May and relatively long rainy season from July to September with the mean annual rainfall ranging from 550 to 850 mm. The area has a monthly mean minimum and maximum temperature of 14.5°C to 34.6°C. The entire territory of the Dire Dawa Administrative Council rests at an elevation ranging between 950 m in the North East to 2260 m in the South West. Due to the narrow altitudinal ranges using the 1500m contour as a line of separation, two agro ecological zones, the low land (below 1500m) and midland (above 1500m) have been recognized [14] The total livestock population in Dire Dawa administrative council is estimated to be about 300,000, including 95,000 goats, 77,000 sheep, 63,000 cattle, 20,000 equine, 19,000 camel and 17,000 poultry. The administrative council is composed of 9 urban and 38 rural kebeles administrations. Large proportion of livestock kept in the arid part of the region mainly by pastoral community [15]

2.2. Study Population and Sampling Methods

The study was conducted in 384 small ruminants (188 sheep and 196 goats) of five kebeles found in and around Dire Dawa Administrative council namely Belawa, Biyo Awale, Ganda Kore, Goladel and Sabean. Purposive sampling depending on their animal population and nearness to the town did the selected villages from the administrative council. Systematic random sampling method was employed at grazing areas and watering point to examine each sheep and goats for the presence Ectoparasite. Risk factors such as, species, sex, age, body condition score, and predilection sites were recorded for each animals selected before examination. Small ruminants all age group and sex were included to study. The age animals were categorized as young (0 up to 1 years), adult (2 up to 4 years) and old (above 4 years old animal) according to the classification method used by [21] Proportional probabilities to the number of animals for each study area were used to determine the number of animals to be considered from each kebele.

2.3. Study Design and Sample Size Determination

A cross sectional study design was used from November 2014 to 2015 May to determine the prevalence of tick infestation and to identify types of ticks species infesting sheep and goats in the study areas. The number of animals to be sampled in the study was estimated by the formula described by [46]

$$(N= 1.96$$

$$2(P_{exp} (1- P_{exp}/ d^2)).$$

Therefore, the sample size was determined by assuming the expected prevalence of 50% tick infestation and setting 95% confidence interval at 5% absolute precision. Accordingly, 384 small ruminants were considered for this study.

2.4. Clinical and Laboratory Investigation

All visible attached adult ticks were collected carefully and gently removed exerting a horizontal pull to the body surface by rotating the tick not to damage the host by the tick mouth parts and then the collected ticks were preserved in properly labeled plastic container containing 70% ethanol. The bottle was labeled with date, place, sex, age and site of the body and then transported to Dire Dawa Veterinary Regional Laboratory for parasitological analysis. The collected ticks from each container was placed onto Petri dishes and examined under stereomicroscope to identify the species using tick identification keys described by [49]; [20] Briefly, the main identification features of the ticks are color, size, and shape of mouth parts, Scutum, anal groove, festoon, punctuation and legs [30].

2.5. Data Analysis

The raw data obtained from selected area and laboratory examination were inserted into Microsoft excel spread sheet to create a data base. The collected data were analyzed using SPSS version 20.0 software program. Descriptive statistics were used to summarize tick species identified. Chi- square test was used to evaluate association between hypothesized risk factors like age, sex, body condition score and species, and tick infestation status of the animal. P-value of < 0.05 was considered as significant.

3. Results

Out of the total 384 small ruminants (188 sheep and 196 goats) examined, 278 (72.39%) were found to be infested with at least a single and/or different species of ticks. High rates of infestations were recorded both in sheep and goats and the corresponding percentage of infestation in sheep and goats was 70.7% and 73.9%, respectively. The difference in prevalence of tick infestation was found statistically significant variation (P < 0.05) between the sex, age and body conditions groups but not between species groups (Table 1).

Table 1: Prevalence of tick infestation based on age, body condition score (BCS), species and sex.

Variable	Category	No of animal examined	No of infested Animal (%)	X ²	P-value
Species	Sheep	188	133 (70.7)	0.5	0.48
	Goats	196	145 (73.9)		
Sex	Female	205	162 (79)	9.7	0.002
	Male	179	116 (64.8)		

Age	Young	57	17 (29.8)	60.78	<0.001
	Adult	238	191 (80.3)		
	Old	89	70 (78.7)		
BCS	Poor	46	40 (86.96)	22	<0.001
	Medium	91	79 (86.8)		
	good	247	159 (64.4)		

BCS=body condition score

Overall, 2294 ticks were collected from 188 sheep and 196 goats. Up on identification, eight different tick species of four genera were identified (Table 2). Considering the relative abundance of each tick species as per the host species involved, *Rhipicephalus pulchellus* was the most abundantly encountered with high burden followed by *Rhipicephalus evertsi evertsi*, *Amblyomma variegatum*, *Hyalomma truncatum*, *Hyalomma marginatum rufipes* and *Amblyomma gemma* in sheep. Similarly, *Rhipicephalus pulchellus* was the most abundant followed by *Amblyomma variegatum*, *Rhipicephalus evertsi evertsi*, *Hyalomma truncatum*, *Boophilus decoloratus* was the minor species observed in both species. All the genus and tick species identified were found infesting both sheep and goats with possible detection of at least one tick (Table 3 and Table 4)

Table 2: Overall prevalence of total tick burden at genera level in the study area

Genus	Tick collected		Prevalence (%)	
	Sheep	Goats	Sheep	Goats
<i>Rhipicephalus</i>	507	498	44.9	42.7
<i>Amblyomma</i>	269	331	23.8	28.4
<i>Hyalomma</i>	296	282	24.2	24.2
<i>Boophilus</i>	56	55	4.9	4.7
Total	1128	1166	100	100

Table 3: Animal-level prevalence of tick infestation in small ruminants of the study area

Tick specie	Goat (n=196)	Sheep (n=188)	Overall prevalence
	Positive (%)	Positive (%)	Positive (%)
<i>Rhipicephalus ev.evertsi</i>	42 (21.4)	43 (22.8)	85 (22.1)
<i>Amblyomma gemma</i>	18 (9.2)	24 (12.8)	42 (10.9)
<i>Amblyomma variegatum</i>	56 (28.6)	38 (20.2)	94 (24.5)
<i>Hyalomma m. rufipes</i>	22 (11.2)	25 (13.3)	47 (12.2)
<i>Hyalomma truncatum</i>	32 (16.3)	28 (14.9)	60 (15.6)
<i>Hyalomma dromedaries</i>	8 (4.1)	8 (4.3)	16 (4.2)
<i>Boophilus decoloratus</i>	16 (8.2)	18 (9.6)	34 (8.9)

Rhipicephalus ev. evertsi (*Rhipicephalus evertsi evertsi*)

Hyalomma m. rufipes (Hyalomma marginatum rufipes)

Table 4: Total adult tick species, sex ratio and their preferred predilection in small ruminants of the study area

Tick species	Male tick No.	Female tick No.	Sex ratio (Female: Male)	Predilection site
Rhipicephalus pulchelus	322	321	0.99:1	Ear, head, under tail
Rhipicephalus ev. ev	219	143	0.65:1	Ear, head, under tail, leg
Amblyomma gemma	116	82	0.71:1	Ear, head, under tail, leg
Amblyomma variegatum	236	166	0.7:1	Ear, head, under tail, leg
Hyalomma m. rufipes	119	66	0.55:1	Ear, under tail, anus
Hyalomma truncatum	196	136	0.69:1	Ear, leg, under tail
Hyalomma dromedaries	35	26	0.74:1	Ear, head, under tail
Boophilus decoloratus	10	101	10.1:1	Ear, head, under tail

4. Discussion

The current study revealed that tick infestation is still widespread and most significant external Parasites of small ruminants in the study area. In this study, 384 small ruminants were examined and a total of 2294-visible adult ticks were collected from the body of 196 goats and 188 sheep. The distribution and abundance of tick species infesting small ruminants in Ethiopia are vary from area to area. In the present study 278 (72.39 %) of small ruminants were found to be infested by one or more species of ticks. Higher prevalence of tick infestation in the study area was observed. This finding was comparable with the previous investigation conducted by [5] in Beadle district, Oromia Region, Ethiopia, who recorded 76.50% overall prevalence of tick infestation in small ruminants. Similarly the prevalence found in the present study in goats (73.9 %) and in sheep (70.7 %) was lower than the reports done by [4] in Miesso district, Western Hararghe, who recorded a prevalence of 87.5 % (goats) and 89.9 % (sheep), [18] recorded a higher prevalence of 97.58% (goats) and 69.86%(sheep) in Dhas district of Borana pastoral area, Southern Rangelands of Ethiopia. However, lower prevalence 66.12% (goats) and 80.30% (sheep) was recorded in Bedelle district, Oromia Region, Ethiopia [2]. However, the prevalence of tick infestation in the current study was higher than previous works conducted by [1] in selected districts of Tigray region, Ethiopia with prevalence of 58.8% (goats) and 40% (sheep), [51]. In and around Wolaita Soddo, Southern Ethiopia with the prevalence of 18.6% (goats) and 31.8% (sheep) and [35]. in North East Ethiopia with prevalence of 3.4% (goats) and 22.2% (sheep). The difference in the Prevalence might be due to the geographical difference, and season of the study period, frequent exposure to the same communal grazing land that favored the frequent contact and management of animals. The prevalence of tick infestation between age groups was statistically significant ($P < 0.05$). The difference between age groups was in agreement with the study conducted by [45] in and around Gondar town.

The probable reason for this might be due to the fact that young animals were grazing around home than adult and old. This in turn contribute to a minimum rate of exposure by tick since the number of ticks less around home as compared to animals graze in pasture mostly adult and old animals [33] The infestation of ticks was statistically significant ($P < 0.05$) among body condition of animals. This is in agreement with the study conducted by [34] in Mizzen Teferi. This is due to high infestation of tick result poor body condition due to consumption of high amount of blood and fluid by those ticks. The prevalence of tick infestation was higher in females (79 %) than in males (64.8 %). Although the exact cause of higher prevalence of tick infestation in female animals cannot be explained but it can be assumed that some hormonal influences may be associated with this phenomenon. In fact, higher level of prolactin and progesterone hormones could make the females more susceptible to any infection [26].

Moreover, stress of production, as, pregnancy and lactation could have made the female animals more susceptible to infection. The principal tick species infesting small ruminants in the study area comprise *Amblyomma gemma*, *Amblyomma variegatum*, *Boophilus decoloratus*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus pulchellus* and *Hyalomma truncatum*, *Hyalomma marginatum rufipes* and *Hyalomma dromedari*. *Hyalomma dromedari* and *Boophilus decoloratus* were less frequent. *Rhipicephalus pulchellus* was the most abundant tick species in the area. [4] Where *Rhipicephalus pulchellus* was the most abundant tick species in small ruminants at Miesso district, west Hararghe area, also reported a similar finding. It is widely distributed and common on domestic livestock in Ethiopia [37]

This further indicated that the finding of this tick in the area is in line with its wide spread occurrence in most parts of the country. *Hyalomma dromedari* was the least frequently encountered ticks during the study period. It prefers to infest camel, but also sheep, goats, cattle and dogs. In Ethiopia, it is mainly collected from camel and though cattle may also harbor quite large infestations in Oromia, Southern Nations Nationalities and Peoples, Afar and Gambella Regional States [37]. It occurs in arid and semi-arid areas and in woodland, bush land as well as grassland with either trees or bushes present [23].

This could explain why only few *Hyalomma dromedari* ticks were collected in the current study area. The finding of such little counts in the current work could probably be attributed to unrestricted movement of camel and mixed livestock husbandry system of the region. The male to female ratios of *B. Decoloratus*, *R. Evertsi-evertsi*, *R. pulchellus*, *A. variegatum*, *A. gemma*, *H. truncatum*, *H. m. rufipes* and *H. dromedari* were similar to previous reports [36]; [39] Except *B. decoloratus*, all other species tick's males outnumbered females because males normally remain on the host longer than females.

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 [39]. The females of *B. decoloratus* ; outnumbered males in this study probably due to small size of male, which may not be seen during collection [44]

Ticks are the most important ectoparasites of livestock in tropical and sub-tropical areas, and are responsible for severe economic losses both through the direct effects of blood sucking

and indirectly as vectors of pathogens and toxins. This study also confirms that ticks still big concern of ectoparasites and which pose significant challenges to small ruminant production and health of the study area.

5. Conclusion and Recommendations

This study a wide spread occurrence of tick infestation in small ruminant was observed and eight species of ticks grouped under four genera were identified. *Rhipicephalus evertsi evertsi*, *Hyalomma truncatum*, *Rhipicephalus pulchellus*, *Amblyomma variegatum*, *Hyalomma marginatum rufipes*, *Boophilus decoloratus*, and *Amblyomma gemma*, *Hyalomma dromedari* were among the tick species identified in the study area. The most important and abundant tick species identified in study area were *Rhipicephalus pulchellus* and *Amblyomma variegatum* in order of predominance.

The prevalence of tick's infestation in this study was statically significant within sex, age and body condition of animals. Generally, ticks are highly prevalent in a study area this is due to inadequate veterinary services, favorable climatic conditions and poor awareness of owners on the impacts of tick infestations and lack of effective and planned control strategy in the study area. Ticks are responsible for severe economic losses both through the direct effects of blood sucking, by damage to hide and skin indirectly by transmitting variety of diseases.

Therefore, better control could be attained if an emphasis is be in put on acaricide small ruminants as per the current finding. Further studies on epidemiological occurrence and the influence of environment, tick related risk factors, and of tick-borne diseases, as well as related factors are recommended as these may provide a benchmark to design appropriate and control and prevention in the area.

References

- [1] Abebe, R., Tatek, M., Megersa, B., and Sheferewu, D. (2011): Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia. *Global Veterinaria*.7 (5): 433-437.
- [2] Abunna, F., Kasasa, F., Shelima, B., Megersa, B., and Regassa, A. (2009a): Survey of tick infestation in small ruminants of Miesso district, west Harargie, Oromia region, Ethiopia, *Tropical Animal Health Production*. 41: 969-72.
- [3] Abunna, F., Kasasa, D., Shelima, B., Megersa, B., Regassa, A. and Amenu, K. (2009b): Survey of tick infestation in small ruminants of Miesso district, West Harargie, Oromia Region, Ethiopia. *Tropical Animal Health Production*. 41: 969-972.
- [4] Abunna, F., Kasasa, B., Shelima, B., Megersa, B., Regassa, A., and Amenu, K. (2007): Survey of tick infestation in small ruminants of Miesso district, West Harargie, Oromia Region, Ethiopia. *Tropical Animal Health and Production*. 41: 969-972.
- [5] Abunna, F., Turaand, J., and Regassa, A. (2012a): Status of tick's infestation in small ruminants of Bedelle district, Oromia Region, Ethiopia. *Global Veterinaria*. 8(5): 459-462.
- [6] Abunna, F., Turaand, J., and Regassa, A. (2012b) Status of tick's infestation in small ruminants of Bedelle district, Oromia Region, Ethiopia. *Global Veterinaria*. 8(5): 459-462.
- [7] Alekaw, S. (2000): Distribution of ticks and tick borne disease at Metekel ranch, Ethiopia. *J. Eth.Vet. Asso*. 4: 40-60.

- [8] Asnake, F., Yacob, K., Hailu, T., Tolossa, M., and Hagos, A. (2013): Ectoparasites of Small Ruminants in Three Agro-Ecological Districts of Southern Ethiopia. *Afr. J. Basic Appl. Sci.* 5(1): 47-54.
- [9] Bayu, K. (2005): Standard veterinary laboratory diagnostic manual. Vol. III. MOA Addis Ababa, Ethiopia. Bebe, F. (2001): Prevalence and intensity of ectoparasites infestation in ISSA camels, Eastern Ethiopia. DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
- [10] Bekele, T. (2002): Studies on Seasonal Dynamics of Ticks of Ogaden Cattle and Individual Variation in Resistance to Ticks in Eastern Ethiopia. *J. Vet. M.* Blackwell Verlag, Berlin. 49: 285-288.
- [11] CSA, (2004): Ethiopian agricultural sample enumeration result for SNNPR. Statistical report on livestock and farm implements. Part IV: 29-304. De Castro JJ (1994). Survey of tick species.
- [12] Daniel, W. (1994a): Survey of tick species of cattle, sheep, and goats in south Wollo region Ethiopia. DVM Thesis, Addis Ababa University, facul. Vet. Med, Debre Zeit, Ethiopia.
- [13] Daniel, W. (1994b): Survey of tick species of cattle, sheep, and goats in south Wollo region Ethiopia. DVM Thesis, Addis Ababa University, facul. Vet. Med, Debre Zeit, Ethiopia.
- [14] DDAC, Agricultural Bureau. (1998): Land use development potential study of the Dire Dawa Administrative council. Pp: 188-99.
- [15] DDLAC, (2005): Dire Dawa Livestock and Agricultural Centre. Pp: 1-23.
- [16] De Castro, J. J. (1997): Sustainable tick borne diseases control in Western Ethiopia. *J. S. Afr. Vet. Assoc.* 71(4):240-243.
- [17] Etagegnehu, D. (1992): Constraints to sheep production. A case control study of the Chaffey State farm, South Wollo, northeastern Ethiopia. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [18] Eyob, E., and Matios, L. (2014): Preliminary Survey on the Distribution of Ixodid Ticks in small Ruminants of Dhas district of Borena pastoral area, Southern Rangelands of Ethiopia. *Advanced in Biological research.* 5: 87-91.
- [19] Ferede, B., Kumsa, B., Bsrat, A., and Kalayou, S. (2010): Ticks of donkeys in central Oromia regional state, Ethiopia, *Revue de Médecine Vétérinaire.* 161: 121–126.
- [20] Fischer, M., and Ralph Say, R. (1989): Manual of Tropical Veterinary Parasitology. CAB International, Wallingford, U.K. Part III by P.-C. Morelon Tick-borne diseases of Livestock in Africa has information on biology and identification. Guide to identification of species. *Bioscience Report.* Pp: 1-221.
- [21] Gatenby, M. R. (2002): Sheep, revised edition. The Tropical Agriculturalist, CTA and Macmillan, Wageningen. Pp: 128-135.
- [22] Gebre, S., Nigist, M., and Kassa, B. (2001): Seasonal variation of ticks on lambs and kids at Sebeta in western Shewa Zone. *Ethiopian Veterinary Journal.* 7 (1&2): 17-30.
- [23] Horak, I.G., Stoltz, W.H., and Heyne, H. (2003): Short course in the identification of southern and northeast African ticks. Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, South Africa. Pp: 110
- [24] Kassa, B. (2006): 'Cockle, mange and pox: Major threats to the leather industry in Ethiopia. Ethiopian leather industry: Perseverance towards value addition', Proceedings of the National Workshop, AddisAbaba, Ethiopia, December 14–15, 2006. Pp: 71–92.
- [25] Lefebvre P.C., Blancou, J., Chermette, R., and Uilenberg, G. (2010). Infectious and Parasitic diseases of livestock. 1:93-128.
- [26] Lloyd, S. (1983): Effect of pregnancy and lactation up on infection. *Vet. Immunol. Immunopath.* 4: 153-176.
- [27] Mehari, B. (2004): Distribution of livestock tick species in Awassa area. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [28] Minjauw, B., and McLeod, A. (2003a): Tick borne diseases and poverty. The impact of ticks and tick borne diseases on livestock owners in India and Eastern health program center for tropical veterinary medicine, University of Edinburgh, UK. Pp: 24-57.

- [29] Minjauw, B., and McLeod, A. (2003b): Tick borne diseases and poverty. The impact of ticks and tick borne diseases on livestock owners in India and Eastern health program center for tropical veterinary medicine, University of Edinburgh, UK. Pp: 24-57.
- [30] Onkello-Onen, J., Hassan, S.M., and Essuman, S. (2006): Taxonomy of Africa tick: An identification Manual. International Center for Insect Physiology and Ecology Press, Nairobi, Kenya. Pp: 1-124.
- [31] Pegram, R.G., Hoogstral, Y., and Wassef, H.Y. (1981): Ticks (Acari: Ixodidae) of Ethiopia. Distribution, ecology and host relationship of species infesting livestock. Bulletin of Entomological Res. 71: 339-359.
- [32] Radostits, M.O., Gay, C. C., Blood, D.C., and K.W. Hinchcliff, K.W. (2000): Veterinary medicine: a Textbook of the diseases of cattle, sheep, pigs, goats and horses. Saunders, London. Pp: 1401-1405.
- [33] Rasmi, G.R., M. Glinsharifodini and S. Sarvi, 2007. Prevalence of Ixodids ticks on small ruminants in Mazandoran province, Iran, Korean. Global Veterinaria. 68: 12-15.
- [34] Seid, B. (2004): Survey of cattle tick species in and Around Mizzen Teferi, Bench Majizone of SNNPS. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University Debrezeit, Ethiopia.
- [35] Sertse, T., and Wosene, A. (2007): A study on ectoparasites of sheep and goats in eastern part of Amhara region, Northeast Ethiopia. Small Ruminant Research. 69:62-67.
- [36] Seyoum, Z. (2001): Study of tick and TBDs on cattle at Girran valley in the North Wollo Zone. Proceeding the Ethiopia Vet. Assoc. Pp: 15.
- [37] Sileshi, M., Pegram, L. G., Solomon, G., Abebe, M., Yilma, J., and Sileshi, Z. (2007a): A synthesis Review of Ixodids (Acari: Ixodidae) and Argasids (Acari: Argasidae) ticks in Ethiopia and their possible role in disease transmission. Ethiopia. Vet. J. 11(2): 1-24.
- [38] Sileshi, M., Pegram, L. G., Solomon, G., Abebe, M., Yilma, J., and Sileshi, Z. (2007b): A synthesis Review of Ixodid (Acari: Ixodidae) and Argasids (Acari: Argasidae) ticks in Ethiopia and their possible role in disease transmission. Ethiopia. Vet. J. 11(2): 1-24.
- [39] Solomon, G., Night, M., and Kaaya, GP. (2001a): Seasonal variation of ticks on calves at Sabetha, Western Shewa zone. Ethiopia Vet. J. 7(1&2):17-30.
- [40] Solomon, G., Night, M., and Kaaya, GP. (2001b): Seasonal variation of ticks on calves at Sabetha, Western Shewa zone. Ethiopia Vet. J. 7(1&2):17-30.
- [41] Steele, M. R. (1996): Goats. The Tropical Agriculturalist, CTA and Macmillan, Wageningen, Pp: 79-86.
- [42] Surafael, M. (1996): Survey on tick species in four domestic animals in Tigray Region. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [43] Tedla, H. (1991): Identifications of tick species and distribution in cattle, camel, sheep and goats of Eastern Hararghe. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [44] Tessema, T., and Gashaw, A. (2010): Prevalence of ticks on local and crossbreed cattle in and around Asela Town, South East, Ethiopia, Amber Animal Health Department, East Gojam, Ethiopia Vet. J. 14(2):79-89.
- [45] Tewodros, F., Fasil, W., Mersha, C., and Malede, B. (2012): Prevalence of Ectoparasites on Small Ruminants in and Around Gondar Town. Journal of Scientific Research. 7(3): 106-111.
- [46] Thrusfield, M. (1995): Veterinary Epidemiology, Second Edition. U.K: Blackwell .Science Ltd. W.B. Sounder Company. Pp: 1-78.
- [47] Walker, A. R., Bouatour, J. L., Camicas, A., Estrada Pena, I.G., Horak, A. A., Latif, R. G., Pegram, R.G., and Preston, P.M. 2007. Tick of domestic animals in Africa: A Guide to identification of species. Bioscience Report. Pp: 1-221.
- [48] Walker, A. R., Bouattour, A., Camicas, J.-L., Estrada-Pena, A., Horak, I.G., Latif, A.A., Pegram, R.G., and Peston, P.M. (2003): Ticks of Domestic Animals in Africa. A Guide to Identification

- of species. International Consortium on Ticks and Tick-borne Diseases (ICTTD-2), Bioscience Reports, the University of Edinburgh, UK. Pp: 221.
- [49] Walker, A., Bovattour, J., Camicas, I., Horak and Latif, A. (2003): Ticks of domestic animals in Africa: A guide to identification of species. Bio Science. Report. Pp: 1-122. Wallingford, UK. Pp: 440-485.
- [50] Wallaga, D. (1997): Survey of ticks and tick-borne diseases in eight domestic animals in and around Debre Zeit, Eastern Shoa, Ethiopia. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [51] Yacob, H.T., Yalow, A.T., and Dink, A. A. (2008): Ectoparasites prevalence in sheep and in goats in and around Wolaita Soddo, Southern Ethiopia. American-Eurasian Journal of Agriculture and Environmental Scientific Research. 159: 450-454.
- [52] Yitbarek, G. (2004): Tick species infesting livestock in Jemma area, Southern Ethiopia. DVM Thesis, Addis Ababa University, facul. Vet. Med. Debre Zeit, Ethiopia.
- [53] Zelalem, A., and Fletcher, I.C. (1993): Small ruminant productivity in the central Ethiopian mixed farming system: In proceedings of the 4th National Livestock Improvement conference, 13-15 November IAR, Addis Ababa, Ethiopia.
- [54] Zeleke, M., and Bekele, T. (2004): Species of ticks on camels and their seasonal dynamics in Eastern Ethiopia. Tropical Animal Health and Production. 36: 225-231.

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