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A study on ticks affecting camels (*Camelus dromedarius*) in Jigjiga district of Somali region, Eastern Ethiopia

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Abstract

This survey was carried out in the Jigjiga districts, Eastern Ethiopia; during the period from November 2013 to April 2014 to determine the prevalence of tick infestation and identify the type of tick species that infesting camels. Seven different predilection sites on camel were collected from all visible adult tick specimens. The overall prevalence of tick infestation in the study area was 318 (82.8%) out of 384 of examined camels. In this study, a total of 5,090 adult ticks of eight species, which grouped under four genera, were collected and identified using direct stereo microscopy. The genera identified during study period includes: *Rhipicephalus, Ambylomma, Hyalomma,* and *Boophilus.* The most abundant tick species was *Rhipicephalus pulchellus* (37.5%), followed by *Hyalomma dromedarii* (20.1%), *Ambylomma gemma* (11.9%), *Hyalomma trancatum* (8.2%), *Hyalomma marginatum rufippes* (6.3%), *Ambylomma variegatum* (6.2%), *Boophilus decoloratus* (5.4%) and *Amblyomma lepidium (*4.6%). The infestation rate of tick showed statistically significant variation ($p<0.05$) on body condition of the animals. However, no association was observed ($p>0.05$) in prevalence of tick infestation between the sex group, age group and the origin of animals. The highest infestation level of ticks was observed on the Udder/Scrotum (21.7%) and the lowest (5.4%) was observed on the Back/side of the animal's body region. The sex ratios of all tick species identified were skewed towards male except for *B. decolaratus.* The high prevalence of tick infestation of camels in the Jigjiga district may be due to favourable climates, poor level of management, poor awareness of farmers and poor animal health extension services may necessitate urgent prevention and control intervention in the region.

Keywords: *Camelus dromedaries*, Tick, Prevalence, Jigjiga district, Ethiopia

1. Introduction

Ethiopia is believed to have the largest livestock population in Africa. The livestock sector has been contributing considerable portion to the economy of the country. Ethiopia is one of the largest camel populated countries in the world. In Africa, it ranks third next to Somalia and Sudan. About 1,102,119 of camels found in Ethiopia, distributing in Southern, Eastern, North Eastern arid and semi-arid regions of the country mainly in Ogaden, Borana and Afar regions (CSA, 2013). In Ethiopia, the one humped camel (*Camellus dromedarius*) is an important livestock species in the pastoral economy because of its extraordinary ability to perform in arid and semi-

arid environments where there is scanty vegetation (Dinka *et al.,* 2010).

The camel plays a significant role as a primary source of subsistence in the lowlands of the country. It lives in wide arid and semi-arid areas, which are not suitable for crop production and less suitable for other livestock production. Therefore, in this part of the country the camel are superior to all other livestock in terms of food security. The camel's importance will increase with continuing land degradation and rapidly growing human population (Bekele, 2010).

The presence of different agro climatic zones and diversified environment makes the country suitable for different kinds of livestock disease. Ethiopia's great livestock potential is not properly exploited due to different factors such as traditional management system, limited genetic potential, and lack of appropriate disease control policy and lack of appropriate veterinary services (EARO, 2000).

A wide range of various external and internal parasitic diseases have been reported to be the major problems affecting the health, productivity and performance of domestic animals. Among external parasites, ticks are definitely the most important ecto-parasites of livestock on global scale. Ticks are destructive blood sucking ecto-parasites, found in most if not all the countries of the world, but are of greater economic importance in the tropical and sub-Tropical zones (Maha *et al.,* 2010). The importance of ticks is principally due to the ability to transmit a wide spectrum of pathogenic microorganisms, such as protozoa, rickettsial, bacterial, spirochetes and viruses. In Africa, tick-borne protozoan diseases (e.g. theileriosis and babesiosis), rickettsial diseases (e.g. anaplasmosis, Rocky Mountain Spotted Fever and heart water [cowdriosis]), Bacterial diseases (e.g. Tularaemia), Spirochaetes (e.g. Lyme disease = "tick-borne disease affecting human" and Relapsing fever) and Viral diseases (e.g. Louping ill and African Swine Fever) are the main health and management problems of livestock (Wall and Shearer, 2001).

The main effect of tick infestation in one humped camel is mild to severe anaemia, loss of appetite, leading to a reduction in growth rate and decreased productivity (Mohsen *et al.*, 2013). Additionally, ticks are responsible for direct damage to the camels through their feeding habits, damage to udders, teats and scrotum, myiasis due to infestation of damaged sites by maggots and secondary microbial infections (Urquhart *et al*., 1996). Tick paralysis in camels is a syndrome that appears to be rare; it has only been reported in Sudan and is apparently caused by *Hyalomma* spp. adults and/or *Rhipicephalus* spp. adults or nymphs (Musa and Osman, 1990).

There are at least 840 tick species in two major families, namely the Ixodidae or 'hard 'ticks (so called by virtue of their hard dorsal shield) and the Argasidae or 'soft 'ticks (due to their flexible leathery cuticle). The family Ixodidae comprises approximately 80% of all tick species, including the species of greatest economic importance (Jongejan and Uilenberg, 1994)**.**

Ticks which are considered to be most important to the health of livestock in Africa comprise about seven genera. Among these ticks, generally the main ticks found in Ethiopia include:- *Amblyomma, Boophilus, Haemaphysalis, Hyalomma* and *Rhipicephalus*. And also there are 20 species of ticks exists on livestock, all of which have damaging effect on production and productivity (Kassa, 2005; Ayele and Mohammed, 2013).

Extensive surveys have been carried out on the distribution of tick species on livestock in different regions of the country. In Gamo Gofa (Jewaro, 1986), Bale (Dejenu, 1988), Shewa Zone (Gebre *et al.*, 2001), Jimma zone (Abebaw, 2004), Wolayta, Southern Ethiopia (Desie, 2005), two district of Somali regional state (Rahmeto *et al*., 2010), Asella (Tamiru and Abebaw, 2010), Holeta Town (Belew and Mekonnen, 2011), Chilga, North West Ethiopia (Nibret *et al.*, 2012), in Mekelle (Hilina, 2012), the highland area of Harar and Dire Dawa (Ayele and Mohammed, 2013), in Borana (Ayana *et al*., 2013) and Haramaya town (Bedasso *et al.*, 2014). The distribution limits of ticks are not fixed and constant, but are determined by a complex interaction of factors such as climate, host density and host susceptibility (Solomon, 2003). Such responsible factors are essential for effective tick and tick borne diseases (TBDs) control strategies (Alanr, 2011).

It is important to know the geographical distribution and prevalence of the tick species for the control of ticks and TBDs (Zelalem, 1994). Moreover, there was not specific study conducted on status of tick infestation on camels in Jigjiga district.

1.1 Objective of the study

1.1.1 General objective

The study was intended to determine the prevalence of camel tick in Jigjiga district of Somali Regional States of Ethiopia and to generate base line data for effective control measure in the study site.

1.1.2 Specific objective

- to assess the prevalence of ticks on camels found in Jigjiga district
- to identify the tick species with their favourable predilection site and the tick burden in different groups of age, sex and body condition in Jigjiga district

2. Materials and Methods

2.1. Study area

The study was conducted in four purposively selected peasant associations (Qordare, Karamare, Horlay and Duduma'as) of Jigjiga districts in Somali Regional State of Ethiopia. Jijiga district is one of the eight administrative districts of Fafan zone. The Jijiga district is located at about 628 Km eastern of Addis Ababa. The average altitude is 1,800 m.a.s.l. The area receives annual rain fall of 410-820 mm of the long rain season occurring from July to October while the short one occurs in months of March to May. The climatic condition is semi-arid and the mean maximum temperature ranges from 19^0c-30^oc. The farming system of the area includes pastoral, agro-pastoral and urban livelihood system. The livestock populations of the district are: 8,403 Camels, 139,882 Cattle, 375,970 Sheep, 156,629 Goat and 12,116 Equine (CSA, 2013).

2.2. Study Animals

The study was conducted on one humped camels (*Camelus dromedarius*) found in Jigjiga district. Camels of all age and sex group were included in this study.

2.3. Study Design

A cross-sectional study was conducted from November 2013 to April 2014 to determine the prevalence of tick infestation and to identify types of tick's species infesting on one humped camels (*Camelus dromedarius*) found in Jigjiga district. Moreover, favourable predilection site of the tick species on the animal body, the relative tick burden and a possible risk factor such as age, sex, origin, and body conditions of the animal was measured.

2.4. Sample Size Determination

The sample size was determined based on the formula recommended by Thrusfield (1995) for simple random sampling method. Since there was no previous work done on this area, a 50% expected prevalence was used to calculate the required sample size. Therefore, the sample size in this study was calculated using the following formula.

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

Where, N = sample size required
1.96 = the value of Z at 95% confidence interval
P_{exp} = expected prevalence (50%)
d = desired absolute precision (5%)
Hence, the sample size required as per above formula was 384 heads camels.

2.5. Study Methodology

2.5.1 Sample collection

Camels were examined carefully for ticks with the help of the camel owners or their assistants. Predilection sites for ticks, such as the head, neck, sternum, under tail, ventral, scrotum/udder, and back/side surface of the body of the animals were carefully examined by visual inspection and palpation of skin. All visible adult ticks attached on these areas of animal bodies were collected carefully and gently removed. Then the collected ticks were preserved in properly labelled tick collection bottle containing 70% alcohol. The bottles were labelled with date of collection, place, sex, age and site of the body and then transported to Jigjiga Regional Veterinary Diagnostic and Research Laboratory for storage and eventually for tick identifications.

2.5.2 Tick Identification

The collected ticks from each bottle were placed onto Petri dishes and examined under stereomicroscope to identify to the species level using tick identification keys described by Walker *et al*., (2003). Briefly, the main identification features of the ticks were scutum,

anal groove, festoon (ornamentation), colour, size, shape of mouthparts, and legs colour.

2.6. Data Management and Analysis

Data obtained in this survey was entered in MS Excel work sheet and analysed using STATA® version 11, for windows software. Simple descriptive statistical analysis was used to analyse prevalence of tick species and its attachment site. Chi-square test (χ^2) was applied to compare the infestation rate with regard to age, sex, origin, and body conditions. A 95% confidence interval and a 5% absolute precision level were used to determine whether there was significant difference between measured parameters.

3. Results

The current survey was done on camels found in four peasant associations (PAs) namely: Qordare, karamare, Horlay and Duduma'as of Jigjiga district. From the total of 384 camels examined, 318 (82.8%) were found to be infested by ticks. Out of these, 72 Qordare, 84 Duduma'as, 108 Karamare and 120 Horlay with prevalence of 59 (81.9%), 70 (83.3%), 89 (82.4%), and 100 (83.3%) of ticks' infestations were recorded, respectively. There was no statistically significance difference observed in tick infestation between origins of the animals (p> 0.05) (Table 1).

Table 1: Prevalence of tick infestation based on place sampling

Place/Area	Total No. of Animals Sampled	No. of Positive Animals (%)	χ2	P-value
Qordare	72	59 (81.9)		
Duduma'as	84	70 (83.3)	0.0894	0.993
Karamara	108	89 (82.4)		
Horlay	120	100 (83.3)		
Total	384	318 (82.8)		

Regarding sex, 220 females and 164 male camels were examined, out of which 189 (85.9%) and 129 (78.7%) were infested by different ticks species, respectively (χ2 = 3.4703 and *p*= 0.062) (Table 2). The difference in tick infestation rate between sex groups was not statistically significant (p> 0.05).

Table 2: Prevalence of tick infestation based on sex categories

Sex	No. of Examined Animals	No. of infested Animals (%)	χ2	P-value
Male	164	129 (78.7)		
Female	220	189 (85.9)	3.4703	0.062
Total	384	318 (82.8)		

As indicated in Table 3, the prevalence of tick infestation in adult is found to be 84.4% (211/134) and that of the young is 79.9% (107/250). There was no statistically significant variation detected between age groups (p> 0.05) and rate of tick infestation.

Table 3: Prevalence of tick infestation based on age categories

Age	No. of Examined Animals	No. of infested Animals (%)	χ2	P-value
≥ 3 Years	250	211 (84.4)		
< 3 Years	134	107(79.9)	1.2685	0.260
Total	384	318 (82.8)		

According to body condition scoring (BCS), camels were grouped into three namely: good, medium and poor, with infestation rate of 48.4%, 76.6% and 98.4%, respectively. There was statistically significant difference [p=0.000] in infestation rate among camels that have different body conditions (Table 4).

Table 4: Prevalence of tick infestation on camels of different body condition categories

Body Condition	No. of Examined Animals	No. of infested Animals (%)	P-value	OR	[95%CI OR] [Lower-Upper]
Good	64	31 (48.4)			
Medium	128	98 (76.6)	0.000	3.48	1.84-6.58
Poor	192	189 (98.4)	0.000	67.06	19.38-232.08
Total	384	318 (82.8)			

In the survey, a total of 5,090 adult ticks were collected from half body region of 384 examined camels. Eight tick species belonging to four genera were collected in the district. The abundant tick genera identified were *Rhipicephalus* (37.5%) followed by *Hyalomma* (34.6%), *Amblyomma* (22.5%) and *Boophilus* (5.4%). Specifically the identified species were: *Hyalomma dromedarii, Hyalomma truncatum, Hyalomma marginatum rufipes, Amblyomma variegatum, Amblyomma lepidium, Amblyomma gemma, Boophilus decoloratus and Rhipicephalus pulchellus* (Table 5 & 6).

Table 5: Distribution of camel ticks genera in the study area

Tick Genera	Total No. Tick	Relative Prevalence
Rhipicephalus	1908	37.5%
Hyalomma	1761	34.6%
Amblyomma	1146	22.5%
Boophilus	275	5.4%
Total	5090	

Table 6: Ticks species, sex ratio and percent of abundance

Tick Species	No. of Male	No. of Female	Total No. Ticks	Female to Male ratio	Relative Prevalence
Hy. dromedarii	606	418	1024	1:1.45	20.1%
Hy. truncatum	249	167	416	1:1.47	8.2%
Hy. m. rufipes	221	100	321	1:2.21	6.3%
Am. gemma	437	163	600	1:2.68	11. 8%
Am. Lepidium	150	83	233	1:1.8	4.6%
Am. variegatum	203	110	313	1:1.84	6.2%
B. decoloratus	70	205	275	1:0.34	5.4%
Rh. pulchillus	1432	476	1908	1:3	37.5%
Total	3368	1722	5090		

The current study indicated that every tick species prefers different attachment sites. Among those ticks attachment site, Udder/Scrotum (21.7%), was the most preferred sites followed by under Tail (20.5%), Head (14.9%), Sternum (14.9%), Neck (12.5%), Ventral (10.0%), and then Back/side (5.4%) (Table 7).

Table 7: Distribution of ticks species and proportion in different attachment site

Predilection Site	*Hy. dromedarii*	*Hy. Truncatum*	*Hy. m. rufipes*	*Am. Gemma*	*Am. lepidium*	*Am. Variegatum*	*B. decoloratus*	*Rh. pulchillus*	Total	Relative Prevalence
Under tail	343	_	111	411	_	179	_	_	1044	20.5%
Head	324	_	_	_	_	_	_	437	761	14.9%
Neck	357	189	91	_	_	_	_	_	637	12.5%
Sternum	_	227	_	_	_	134	_	397	758	14.9%
Ventral	_	_	119	_	_	_	_	391	510	10.0%
Udder/Scrotum	_	_	_	189	233	_	_	683	1105	21.7%
Back/Side	_	_	_	_	_	_	275	_	275	5.4%
Total	1024	416	321	600	233	313	275	1908	5090	

4. Discussion

Camels play a significant multi-purpose role in the dry lands of Ethiopia. The commonest uses of camels by the pastoralists are for transporting different goods as well as for milk and meat production. Of a total 384 examined camels, 318 (82.8%) were found to be infested by ticks. Ticks distribution between animal origins was made and the prevalence of tick infestation between areas were almost similar, 81.4% Qordare, 82.4% karamare, 83.3% Horlay and 83.3% Duduma'as. The finding indicated that there is no statistically significant association between rates of camel infestation by ticks and their living area (PAs). This finding agreed with the report of Dinka (2010) in Dire Dawa and disagreed with the report of Rahmeto *et al*. (2010) from Jijiga Zone and Ayele and Mohammed (2013) from Dire Dawa which indicates that tick infestation rates have an association with animals living area. This is due to the effect of climate on tick survival. As Morel (1989) stated the most important ecological factors influencing the occurrence of ticks in a biotope include temperature and relative humidity. The absence of this association in the current study may be attributes to the climatic condition similarities of the PAs.

There was no statistically significant difference ($p>0.05$) in tick infestation rates between host sexes. However, the proportion of tick species in female camels 189 (85.9%) was slightly higher than that of males 129 (78.7%) and this finding agreed with previous finding of Maha *et al.* (2010) in Sudan, Ayele and Mohammed (2013) in Ethiopia and Mohsen *et al.* (2013) in Iran. This may be due to the fact that high female animals mostly dwelling around home for milk production and grazing areas (shrubs) that create easy access for ticks where as male animals mainly used for transportation and hence they are unstable in one area and in close supervision by their owner for tick infestation.

The finding of this study in showed that there is statistically significant association ($p<0.05$) between tick infestation rate and body condition of the camels. The tick infestation rate is higher in camels with poor body condition score (BCS) (98.4%) [OR=67.06, 95%CI=19.38-232.08, p=0.000], followed by camels with medium BCS (76.6%) [OR=3.48, 95%CI = 1.84-6.58, p=0.000] than in camels that have good BCS (48.4%). The higher prevalence in poor body conditioned animals may be due to poor body conditioned animals have ruffled hair coat that allows ticks to penetrate hair and attach the skin of animal easily. But this finding is not compatible with the report of Ayele and Mohammed (2013) from Dire Dawa.

The overall mean tick burden between adult and young categories showed no significant difference ($p> 0.05$) and the prevalence of tick infestation in adult (≥3 year) 211 (84.4%) was similar to that of the young (< 3 year) 107 (79.9) animals. This finding agreed with previous finding of (Eyeruselam, 2008 and Ayele and Mohammed, 2013).

In this study, about 5,090 ticks were collected which belongs to four genera of ticks *(Rhipicephalus, Hyalomma, Ambylomma and Boophilus*) and eight species namely *Rh. pulchellus, Hy. dromedarii, Hy. truncatum, Hy. m. rufipes, Am. gemma, Am. variegatum, Am. lepidium and B. decoloratus.* Except *Am. lepidium* this result was in agreement with the finding of Ayele and Mohammed on a study of camels' ticks in and around Dire Dawa, Eastern Ethiopia. The presence of similar tick species in the districts may be due to unrestricted camel movement from area to area, which is a common phenomenon in the region. Also the current study highly agreed with the report of Rahmeto *et al*. (2010) on a study of cattle ticks in two district of Somali regional state, who found similar genera and species on above results, except two species (*Hy. dromedarii* and *Hy. truncatum*) those prefer a camels.

In this study *Rh. pulchelus* was the most abundant tick species recorded on camel and it accounted a relative prevalence of 37.5%, which is slightly lower to the finding of (Abeba, 2001; Ayele and Mohammed, 2013; and Ayana, 2013) who reported a prevalence of 50%, 46.8% and 46.8%, respectively. This difference may be due to climatic condition and different management practice in the pastoral areas. The higher in number of this species may be due to the fact, as Walker *et al.* (2003) stated that *Rhipicephalus pulchellus* is a tick of savanna, steppe and desert climatic regions. It is one of the commonest ticks present in North East Africa, the Rift Valley and also east of the Rift Valley from Eritrea in the north to north-eastern Tanzania in the south. This species also commonly found among the cattle herd in the same areas Rahmeto *et al*. (2010). It has been considered as the main vector of Nairobi sheep disease (NSD) virus in northern Somalia (Saeed *et al.,* 2011).

Hy. dromedarii was the second predominant species infesting on camel in the current study area. With relative proportion of 20.1%, this result was in agreedment with the finding of Abeba (2001) 20.4% and there is slight difference with the finding of Ayele and Mohammed (2013); Dinka *et al.,* (2010) and Eyeruselam (2008), which reported 26.8% 15.36% and 15.4% respectively. On the other hand it contradicts to the study of Bekele (2010) and Zeleke and Bekele (2004), who reported 1.2% and 3.87% respectively from Ethiopia. This difference might be due to management, agro-ecological and geographical difference. Camels are the preferred hosts of *Hy. dromedarii* (Walker *et al.,* 2003)

Am. gemma (11.8%) was the third most abundant tick species found in the study area. This finding agreed with the report of Ayele and Mohammed (2013) 11.35%, Eyeruselam (2008) 13.6% and Bekele (2010) 15.0% and is quite the opposite with the finding of Zeleke and Bekele (2004), Abeba (2001), and Zelalem (1994) who reported 4.10%, 5.79%, and 7.1% respectively. This difference may be due to application of acaricides and management practice used in different areas. *Am. gemma,* which has long mouth parts are more significant in inflicting udder damage and is of a risk factor for mastitis in camels (Bekele, 2010; Ayele and Mohammed, 2013).

Hy. truncatum was among the moderately abundant tick species with a prevalence of 8.2% in the study area, followed by *Hy. m. rufipes* and *Am. variegatum* which was found almost similar infestation rate, that were 6.3% and 6.2% respectively. This agreed with finding of Ayele and Mohammed (2013) in Ethiopia and that of Maha *et al.* (2010) in Sudan. The smaller infestation rate of these tick species may be requirement of moisture and warm for their survival (Mekonnen, 2007). *Am. variegatum* has a great economic importance, because it is an efficient vector of *Cowdria ruminantum*, the organism causing cowdrosis or heart water (Morel, 1980). Furthermore, ulcer caused by this tick species becomes favorable site for secondary bacterial infection like *Dermatophilus congolensis* (Tamiru and Abebaw, 2010).

B. decoloratus was the second least abundant ticks in the study areas that account 5.4%. This lower number may be associated as (Morel, 1980) stated *B. decolaratus* is often collected in Ethiopia and does not seems abundant anywhere. This tick species is abundant in wetter highlands and sub-highlands receiving more than 800 mm rainfall annually (Belew and Mekonnen, 2011). *B. decoloratus* transmits Babesiosis and Anaplasmosis.

Am. lepidum was the least abundant thick in the study area. It accounts only 4.6% of the total coverage. Little abundance of these species might be associated with availability of suitable hosts since it prefers a cattle or the climatic factor in the study area. This tick transmits the *Cowdria ruminantium*, which causes heartwater and the protozoans Theileria mutans and Theileria velifera which cause benign bovine theilerioses (Walker *et al.,* 2003).

During the study each species of ticks were collected from various body regions of camels. But the

attachment site preference was higher in some species than the other species. The observed proportion of attachment sites for each species of tick during this study was:- *Rh. pulchellus* (Head, Sternum, Ventral and Udder/scrotum), *Hy. dromedarii* (Under tail, Head and Neck), *Hy. truncatum* (Neck and Sternum), *Hy. M. rufipes* (Under tail, Neck and Ventral), *Am. gemma* (Under tail and Udder/Scrotum), *Am. variegatum* (Under tail and Sternum), *Am. lepidium* (Udder/Scrotum) *and B. decoloratus* (Back/Side). In the attachment site preference Back/side was least preference site. This may be due to presence of thick skin and long hair on the back/side. A verity of factors such as host density, interaction between tick species and inaccessibility for grooming determine the attachment site of ticks (Gebre *et al.,* 2001).

With regarding of male to female ratio; in all cases, except for *B. decoloratus*, males outnumbered females; this is most probably because of 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 on the host before dropping off (Abebaw, 2004). Host grooming easily removes semi-engorged or engorged females as compared to males. The females of *B. decoloratus* outnumbered males in this study probably due to the small size of the male which could not be seen and this might be one of the contributory factors for missing of males (Ayana, 2013). Similar report was indicated in the country by (Ayele and Mohammed, 2013; Ayana, 2013; Solomon *et al.,* 2003 and Desie, 2005).

5. Conclusion and Recommendations

It is well known that ticks causes severe economic losses either by transmitting a variety of diseases or affects the health and productivity of animals. The finding of this study showed that there is high prevalence of camel tick infestation in the study site. The factors such as sex, age, origin and BCS were assessed and only BCS has statistically significant association. The camel ticks found in Jigjiga district belongs to four genera and eight species of ticks. The most abundant tick species were *Rh. Pulchillus* and *Hy. dromedarii*, while the least tick species were *B. decoloratus* and *Am. Lepidium*. Most ticks are found on the udder/scrotum and under tail of the animal's body and the back of the animals is the less infested/preferred site.

Based on this, the following points are recommended.

- Appropriate tick control strategy should be implemented in the area
- There should be creation of awareness of the livestock owners as to the impact of ticks and other ecto-parasites on the health and productivity of their animals
- Further detailed investigation on the distribution of ticks in different seasons and diseases they transmit should be conducted

6. References

Abebaw, G. K. (2004): Seasonal dynamics of ticks (*Amblyomma cohaerens* and *Boophilus decoloratus*) and development of a management plan for tick and tick born diseases control on cattle in Jimma zone, south western Ethiopia. *Ethiop. Vet. J.*, **18**: 19-28.

Abebe, F. (2001): Prevalence and intensity of ectoparasite in infestation in Issa camels, Easten Ethiopia. DVM thesis, Faculty of Veterinary Medicine, Addis Abeba University, Debre Zeit, Ethiopia.

Alanr, W. (2011): Eradication and control of livestock ticks: biological, economic and social perspectives. Royal (Dick) School of Veterinary Studies, University of Edinburgh, Summerhall Place, Edinburgh EH9 1QH, UK.

Ayana, D., Eshetu, E., and Abunna, F. (2013): Survey of Ixodid Ticks on Cattle in Borana Pastoral Area, Ethiopia. *Acta Paras. Glob.* **4** (1): 14-23.

Ayele, T., and Mohammed, M. (2013): A Study on Camels Ticks in and Around Dire Dawa, Eastern Ethiopia. *Acta Paras. Glob.* **4**(2): 64-70.

Bedasso, M., Abebe, B., and Degefu, H. (2014): Species composition, prevalence and seasonal variations of Ixodid cattle tick in and around Haramaya town. Ethiopia. *J. Vet Med. Anim. Health*, **6**(5): 131-137.

Bekele, T. (2010): Milk production, fluid balance and temperature regulation in lactating camels (*Camelus dromedarius*). DVM Thesis, Swedish University of Agricultural Sciences, Uppsala.

Belew, T., and Mekonnen, A. (2011): Distribution of Ixodid Ticks on Cattle in and Around Holeta Town, Ethiopia. *Glob. Vet.* **7**(6): 527-531.

CSA (Central Statistical Authority) (2013): Report on Federal Democratic Republic of Ethiopia, Agricultural Sample Enumeration Statistical abstract. Addis Ababa, Ethiopia.

Dejenu, G. (1988): A preliminary survey of ticks on (Acari: Ixidida). *Annu. Rev. Ecol. Syst.*, **20**: 397-430.

Desie, S. (2005): Cattle Tick Dynamics in Different Agro-Ecological Zones of Wolayta, Southern Ethiopia. MSc thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.

Dinka, A., Eyerusalem, B., and Yacob, H. T. (2010): A study on major ecto-parasites of camel in and around Dire Dawa, Eastern Ethiopia. *Revue Vet. Med*., **11**: 498-501.

EARO (Ethiopian Agricultural Research Organization) (2000): Animal science research Directorate, Camel research strategy.

Eyeruselam, B. (2008): Study on major Ecto-parasites of Camels in and around Dire Dawa, Ethiopia. DVM Thesis, FVM, AAU, Debre Zeit, Ethiopia.

Gebre, S., Nigist, M., and Kassa, B. (2001): Seasonal variation of ticks on calves at Sebeta in western Shewa Zone. *Eth. Vet. J*., **7**(1,2): 17-30.

Hilina, b., Berihun, A., and Yasmin, J. (2012): Prevalence and identification of ticks in cattle in and around Mekelle, Ethiopia. *Rev. electrón. vet. Vol*. **13**(9): 091-206.

Jewaro, A. (1986): A survey of tick and tick borne disease in Gamo Gofa administrative region. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debera-zeite, Ethiopia.

Jongejan, J., and Uilenberg, G. (1994): Ticks and control methods**.** *Rev. sci. tech. Off. int. Epiz.*, **13** (4), 1201-1226.

Kassa, B. (2005): Standard Veterinary Laboratory Diagnostic Manual, Veterinary Diagnostic Laboratory, College of Veterinary Medicine at the University of Illinois at Urbana, IL., USA.

Maha, A. El Tigani, and Mohammed, A. S. (2010): Ticks (Acari: Ixodidae) Infesting Camels in El Butana Area, Mid-Central Sudan. *J. Vet. Res*. **25**: 51-54.

Mekonnen, S., Hussein, I., and Bedhane, B. (2007): Integrated Approach to the control of ticks and Tick Born Disease. *J. Eth. Vet. Ass.*, **1**: 30-33.

Mohsen, C., Gholamreza, M., Sadegh, C., Gholamreza, R., Ehsan, M., and Tahmineh, J. (2013): Frequency of hard-ticks and the influence of age and sex of camel on ticks infestation rates in one-humped camel *(Camelus dromedaries)* population in the northeast of Iran. *Sci. Parasitol* **14**(2): 89-93.

Morel, P. (1980): Study on Ethiopia ticks (Acarida, Ixodidea). Republic of France, Minister of Foreign affairs, French Vet. Mission, Addis Ababa, C.J.E.M.V.T, pp. 7-332**.**

Morel, P. (1989): Manual of Tropical Veterinary Parasitology, Tick-borne disease of Livestock in Africa. CAB International, UK. pp. 299-460.

Musa, M. T., and Osman, O. M. (1990): An outbreak of suspected tick paralysis in one-humped camels (*Camelus dromedarius*) in the Sudan. *Revue Elev. Méd. vét. Pays trop.*, **43**: 505-510.

Nibret, M., Basaznew, B., and Tewodros, F. (2012): Hard Ticks (Ixodidae): Species Composition, Seasonal Dynamics and Body Site Distribution on Cattle in Chilga District, Northwest Ethiopia. *Asian J. Agric. Sci.*, **4**(5): 341-345.

Rahmeto, A., Thedrous, F., Mesele, A., and Jemere, B. (2010): Survey of ticks (Acari: Ixodidae) infesting cattle in two districts of Somali Regional State, Ethiopia. *Vet. World. Vol.* **3**(12): 539-543.

Saeed, N., Amin, T., Mohammad-Amin, B., Shahram, H., and Ali-Reza, R-J. (2011): One-Humped Camels (*Camelus dromedaries*) Hard Ticks Infestation in Qeshm Island, Iran. *Vet. Res. Forum*, **2**: 135–138.

Solomon, G., Nigist, M., and Kassa, B. (2003): Seasonal Variation of ticks on Calves at Sebeta in Western Shewa Zone. *Ethiop. Vet. J.*, **7**: 17-30.

Tamiru, T., and Abebaw, G. (2010): Prevalence of ticks on local and crossbred cattle in and around Asella town, southeast Ethiopia. *Vet. J.*, **14**(2), 79-89.

Thrusfield, M. (1995): Veterinary epidemiology 2nd ed., Edinburg, UK. Blackwell Scientific Ltd. pp: 339.

Urquhart, G.M., Armour, A., Duncan, J. L., and Jennings, F.W. (1996): Veterinary Parasitologicy. 2nd ed., Black Well Scientific Ltd., Cambridge, 141-205.

Wall, R., and Shearer, D. (2001): Veterinary Ecto-parasites: Biology, Pathology and Control, 2nd ed., Longman scientific and Technical, N.Y USA: 61-262.

Walker, A.R., Bouattour, A., Camicas, J. J., Estrada, P. V., Horak, I.G., Latif, A. A., Pegram, R. G., and Preston, P. M. (2003): Ticks of domestic animals in Africa: A Guide to Identification of Tick species. Bioscience Report, Edinburgh, Scotland, U.K pp: 1-122.

Zelalem, T. (1994): Survey on mange mites and ticks of camels and small ruminants in Dire Dawa Region, Eastern Ethiopia. D.V.M Thesis, FVM AAU. Ethiopia.

Zeleke, M., and Bekele, T. (2004): Species of ticks on camels and their seasonal population dynamics in Eastern Ethiopia. *Trop. Anim. Health Prod.*, **36**: 225-331.

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