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Cross-Sectional Study on the Prevalence of Ticks, Mange Mite and Lice Infestation in Bovine and Ovine in and Around Bishofitu, Ethiopia

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Abstract: A cross-sectional study was conducted from October 2011 to May 2012 to determine the prevalenceof ticks, mange mite and lice infestation in and aroundBishofitu and to assess risk factors responsible for ectoparasite. The total of 202 cattle and182 sheep were infested by ticks (*Boophilus*, *Amblyomma*, *Rhepicephalus* and *Hyalomma*), lice (*Damalina* and *Linognathus*) and mange mite (*Demodexspp* and *Psoroptesspp*) respectively. Prevalence of tick infestation was 35.15% in cattle and 26.92% in sheep and it varied significantly among sex of both animal species. It also varied among production system in cattle (P^2=29.4; P=0.000) and sheep (P^2=10.34; P=0.001). The highest proportion of tick infestations in cattle were *Amblyomma* (67.6%) followed by *Boophilus* (32.39%), whereas higher proportion of *Amblyomma* (48.98%) and *Rhipicephalus* (46.97%) were isolated from sheep.Prevalence of pediculosis in bovine and in ovine was 8.91% and 1.64%, respectively. Prevalence of pediculosis were found significantly varied among sex (P^2=19.34; P=0.000) and breed (P^2=4.535; P=0.033) in cattle and, production system in cattle (P^2=5.483; P=0.020) and sheep (P^2=6.357; P=0.04). Majority of pediculosis in cattle (72.22%) and sheep (52.17%) were caused by *Linognathus* and *Damalina* spp, respectively. The overall prevalence of mange was 4.43%. Higher proportion demodicosis (5.94%) than psoroptes infestation (0.94%) were detected in cattle. However, only psoroptes at prevalence rate of 2.19% was found to cause mange mite infestation in sheep. Age in cattle (P^2=14.007; P=0.000) and in sheep (P^2=3.834; P=0.040) and body condition in cattle (P^2=7.745; P=0.021) were found significantly associated with the prevalence mange mite infestation.

Key words: Bovine % Ovine % Cross-sectional study % Tick % Mange mite % Lice and ectoparasites

INTRODUCTION

Ethiopia has the largest livestock populationin Africa which is estimated to be 50.8 million heads of cattle, 25.9 million sheep and 21.9 million goats and 1.5 million camels [1]. As a source of high quality protein (meat, milk) livestock contribute to the economy of the farmer by providing hides and skins, power and traction for agricultural purposes and fertilizer for increasing small holding [2, 3]. In Ethiopia, livestock serves as important source of income for the agrarian community and are one of the Ethiopia's major sources of foreign currency through exportation of skins and hides. However, diseases have been the stumbling black against the full utilization of this resource for foreign currency through export of live animals, skin and hides [4]. Currently different causes of skin disease in Ethiopia are a countable for considerable economic loss particularly to the skin and hide export due to various defects, 65% of which occur in the preslaughter slaves directly related to skin disease causing often rejection because of poor quality [5, 6]). Bekele [7]also estimated an annual loss of US$500 000 from hide and skin downgrading from ticks and approximately 65.5% of major defects of hides in eastern Ethiopia are from ticks.

The major ectoparasites are arthropods; insects and arachnids. Among ectoparasites like mites, ticks, lice, fleas and flies, some of these ectoparasites (e.g. ticks) parasitize a wider range of hosts while many of them are host specific (e.g. fleas) [8]. In addition to damaging the hides and skins and other effects on the host, many ectoparasites are known to be vectors of pathogens such

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as bacterial, helminthes, rekettsial, protozoan and viral infections which the parasite typically transmit to hosts by feeding [9].

The main tick genera found in Ethiopia are *Amblyomma, Boophilus, Haemaphysalis, Hyalomma* and *Rhipicephalus* [10]. The most important and widespread tick species are *Amblyomma variegatum* (vector of *Cowdria ruminantum* and *Theileria mutans*) and *Boophilus decoloratus* (vector of *Anaplasma marginale* and *Babesia bigemina*). The effects of ticks on indigenous cattle compared to exotic breeds shown to be minimal. However, over 50 species are known to exist in the country [11].

Both biting and sucking lice affect ruminants. Most species of louse are highly host specific and many species specialize in infesting only one part of their host body [12] and transfer to new hosts by body contact, particularly under condition of close confinement [13]. The sheep chewing lice, *Damalina ovis* (*D. ovis*), is one of the most common lice found on sheep. Infestations with *D. ovis*occur over all areas of the body but the upper sides of the animal are favored. This species move rapidly over the wool fiber but is usually found near the skin. Out of more than 50 species of *Linognathus* described, six occur on domestic animals that parasitize sheep and goats includes;the face louse *Linognathus ovillus*, the foot louse, *Linognathus pedalis;* the goat sucking louse, *Linognathus stenopsis;* and the closely related species, *Linognathus africanus* on sheep and *Linognathus stenopsis* and *Linognathus africanus*on goats [12]. The major lice species recorded in Ethiopian cattle were Linognathusvitulii and Damaliniabovis [14-16].

The transmission of mange mite from host to host is primarily by physical contact and all the stages: the larvae, the nymph and the adult are capable of migrating and inert materials such as bedding and grooming tools can act as a carrier [17]. Psoroptic mange, known as sheep scab, is highly contagious disease of sheep and goats. Infestation by these mites is always superficial on the epidermis and the mites lead to exudation and exfoliation, to form scabs [13]. Demodectic mange mites infest hair follicles of all species of domestic animals. In cattle; there may be significant damage to the hide and rarely death due to gross secondary bacterial invasion. The disease may also be severe in goats [17].

Generally, various skin diseases such as dermatophilosis, demodicosis, sarcoptic and psoroptic mange, tick and lice infestation have frequently been reported in Ethiopia [11, 7, 18, 16 and 19]. However, there is no information on prevalence, distribution and risk factors of ectoparasites of cattle and sheep in and around Bishofitu.The present study therefore to determine the prevalence of major ectoparasites of cattle and sheep in the study area and to assess the risk factors association with ectoparasites infestation.

MATERIALS AND METHODS

Study Area: The study was conducted in and around Bishofitu, East Shoa zone of Oromia regional state. It is located 47 kms south east of Addis Ababa.It located at 9°N latitude and 40°E longitude at an altitude of 1850m.a.s.l. in the central highland of Ethiopia. It has an annual rainfall of 866 mm of which 84% falls during the long rain season (June - September). The dry season tends from October to February. The mean annual to minimum and maximum temperature are 8.9°C and 26.°C, respectively, with mean relative humidity of 58.9% (NMSA, 2003).

Study Design and Study Animals: The study was conducted from October 2011 to May 2012 using cross-sectional study design to determine the prevalence of major ectoparasites, identification of the different genus of ticks, lice and mange mite. This study were conducted on 384 cattle and sheep which consisting of different age groups, sex, body condition and production systems. The age of the animals was estimated using the definition described by Aiello and Mays [24]. Animals were divided into two groups according to their age as described by Yacob *et al*. [18] namely: young (= 1 year old) and adult animals (>1 year old). Body condition score was made by the scoring system described [22, 23] in cattle and sheep, respectively.

Sampling Method and Sample Size Determination: The study animals were selected using systematic random sampling method. The sample size required also obtained using the formula given [24] for systematic random sampling. The sample size calculated at 50% prevalence rate with a desired precision of 5% and 95% confidence interval was 384 animals.

$n = 1.96^2 \times Pexp (1-Pexp)$ Where, n = required sample size
d^2Pexp = expected prevalence
d = desired absolute precision

Collection and Identification of Ectoparasites: After the animal was restrained physically, clinical examination for ectoparasites was performed by visual inspection and palpation of skin for parasites and lesions on all parts of animal. Ectoparasites like tick and lice were collected from the body surface manually and were preserved in proper universal bottle labeled with serial numbers while other data were written on special field register format prepared for this particular purpose (date, address, age, sex of animals and production system). The collected ectoparasites were transported to parasitology laboratory and subsequently identified to Genus level by putting in petridish and examined under stereomicroscope. All collected samples were examined for further identification and confirmed in the laboratory as being ticks, lice and mange mite [25].

Data Analysis: The collected data were entered into Microsoft Excel data sheets and analyzed using STATA 11 statistical software (STATA Corporation, College Station, TX). The prevalence was calculated by dividing the proportion of animals found infested by the total number of animals inspected for external parasite multiplied by 100. The difference between the effects of different risk factors on prevalence was analyzed using the Pearson chi-square (P^2) test. The odds ratio (OR) was calculated to assess the strength of association of different risk factors with the prevalence of ectoparasites. A statistically significant association between variables was said to exist if the calculated P-value was <0.05 and the 95% confidence interval (CI).

RESULTS

Overall Prevalence of Ectoparasites: Out of 202 cattle examined for ectoparasites, 95 were found infested with one or more ectoparasites. Accordingly, the overall prevalence was 47.03% (95% CI: 40.09%-53.97%). On the other hand, out of 182 examined sheep, 73 were found to harbour one or more ectoparasites and thus the overall prevalence was 40.11% (95% CI: 32.9%- 47.3%). Overall eight genera of ectoparasites belonging to ticks, lice and mange mites were found infesting cattle and sheep in the study area. The major identified genera of ticks were *Boophilus, Amblyomma, Rhepicephalus* and *Hyalomma* (Table 1). *Damalina* and *Linognathus, Demodex* and *Psoroptes* were responsible for pediculosis and mange mite infestations, respectively.

Prevalence and Risk Factors of Tick Infestation: Of the 384 examined animals, 120 (31.25%) (95% CI: 26.59%-35.90%) were found to harbor one or more tick genera. Of 202 cattle and 182 sheep examined, 71 (35.15%) and 49 (26.92%) were infested with one or more genera of ticks, respectively. Prevalence of tick infestation were found significantly varied among sex in cattle (P^2=5.429; P=0.02) and sheep (P^2=5.54; P=0.019). Being female were more than two times higher at risk to be infested with ticks than male in cattle (OR=2.16; 95% CI: 1.1-4.18) and sheep (OR=2.23; 95% CI: 1.1-4.4). Similarly, prevalence of tick infestation was significantly varied among management system in cattle (P^2=29.4; P=0.000) and sheep (P^2=10.34; P=0.001). For instance, cattle and sheep managed under extensive management system were more than 12 times (OR=12.1; 95% CI: 4.2-35.2) and 6 times (OR=6.13; 95% CI: 1.8-20.9) higher at risk to be infested by ticks than that of cattle and sheep kept under intensive type of production, respectively (Table 2).

Prevalence and Risk Factors of Pediculosis: Of the 384 examined animals, 41 were found infested with one or more lice, with a prevalence of 32.03% (95% CI: 22.72%-41.34%). The prevalence of pediculosis was 8.91% and 1.64% in bovine and ovine. The prevalence of pediculosis in cattle was significantly varied among sex (P^2=19.34; P=0.000) and breed (P^2=4.535; P=0.033). Female cattle were around 8 times (OR=7.9; 95% CI: 2.8-22.6) more at risk than male for pediculosis. Similarly, cross breed cattle were 3 times (OR=3.0; 95% CI: 1.05-8.8) higher at risk for tick infestation than indigenous local cattle breed (Table 4). Production system were also found significantly associated with the prevalence of pediculosis in cattle (P^2=5.483; P=0.020) and sheep (P^2=6.357; P=0.04). Being cattle and sheep managed under extensive management system was more than 3 times (OR=3.6; 95% CI: 1.8-8.1) and 2 times (OR=2.1: 95% CI: 1.6-4.4) higher to be infested with tick than cattle and sheep managed under intensive, respectively (Table 4).

Majority of pediculosis cases in cattle (72.22%) and sheep (52.17%) were caused by*Linognathus* and *Damalina* species, respectively (Table 3).

Prevalence and Risk Factors of Mange Mite Infestation: Of the 384 examined animals for ectoparasites, 17 were infested with mange mites with a prevalence of 4.42% (95% CI: 1.72%- 7.98%). The prevalence of demodicosis and psoroptic mange in cattle was 5.94% and 0.94%,

Table 1: Tick generaidentified and their prevalence in cattle and sheep

	Bovine		Ovine	
Types of tick genera	No. infested with ticks	No. positive and proportion	No. infested with ticks	No. positive and proportion
Amblyomma	71	48(67.60 %)	49	24(48.98 %)
Rhipicephalus	71	22(30.98 %)	49	23(46.94 %)
Boophilus	71	23(32.39 %)	49	12(24.49 %)
Hyalomma	71	6(8.45 %)	49	-

Table 2: Risk factorassociation with tick infestation in cattle and sheep

	Species							
	Bovine (n=202)				Ovine (n=182)			
Variable	Total	Positive (%)	P^2 (P-value)	OR(95% CI)	Total	Positive (%)	P^2 (P-value)	OR(95% CI)
Sex			5.429(0.02)				5.54 (0.019)	
Male	153	47(30.7)		1	89	18 (20.2)		1
Female	49	24(48.9)		2.16(1.1-4.18)	93	31 (33.3)		2.23(1.1-4.4)
Age			0.007 (0.93)				2.84(0.092)	
Young	42	15 (35.7)		1	46	8(17.39)		1
Adult	160	56 (35.0)		0.9(0.47-1.97)	136	41(30.15)		2.05(0.8-4.8)
Body condition			1.06(0.58)				1.15(0.28)	
Good	84	29(34.5)		1	101	24(23.76)		1
Medium	80	26(32.5)		0.9(0.48-1.75)	-	-		-
Poor	38	16(35.1)		1.4(0.6-3.0)	81	25(30.86)		0.69(0.36-1.35)
Breed			1.23 (0.27)					
Local	170	57(33.5)		1	-	-	-	-
Cross	32	14(43.7)		1.5(0.71-3.32)	-	-	-	-
Production system				29.4(0.000)				10.34(0.001)
Intensive	59	4 (6.78)		1	41	3(7.32)		1
Extensive	143	67(46.8)		12.1(4.2-35.2)	141	46(32.6)		6.13(1.8-20.9)

Table 3: Type of lice identified and their prevalence incattle and sheep

	Bovine		Ovine	
Types of lice	No. infested with lice	No. positive and proportion	No. infested with lice	No. positive and proportion
Linognathus	18	13(72.22%)	23	11(47.83 %)
Damalina	18	5(27.78 %)	23	12 (52.17 %)

Table 4: Risk factor association withpediculosis in cattle and sheep

	Species							
	Bovine (n=202)				Ovine (n=182)			
Variable	Total	Positive (%)	P^2 (P-value)	OR(95% CI)	Total	Positive (%)	P^2 (P-value)	OR(95% CI)
Sex			19.34(0.000)				0.612(0.434)	
Male	153	6(3.92)		1	89	13 (14.6)		1
Female	49	12(24.5)		7.9(2.8-22.6)	93	10 (10.7)		0.70(0.3-1.7)
Age			0.025 (0.876)				0.371(0.542)	
Young	42	4(9.52)		1	46	7(15.22)		1
Adult	160	14(8.75)		0.91(0.3-2.9)	136	16(11.76)		0.74(0.3-1.9)
Body condition			2.299(0.317)				0.117(0.732)	
Good	84	9(10.7)		1	101	12(11.88)		1
Medium	80	8(10.0)		0.9(0.3-2.5)	-	-		-
Poor	38	1(2.6)		0.2(0.02-1.8)	81	11(13.58)		0.86(0.36-2.06)
Breed			4.535 (0.033)					
Local	170	12(7.06)		1	-	-	-	-
Cross	32	6(18.7)		3.0(1.05-8.8)	-	-	-	-
Production system				5.483(0.020)				6.357(0.04)
Intensive	59	2(3.39)		1	41	3(7.32)		1
Extensive	143	16(11.2)		3.6(1.8-8.1)	141	20(14.18)		2.1(1.6-4.4)

Table 5: Identified mange mite and their prevalence in cattle and sheep

	Bovine	Ovine	
Type of mange mites	No. positive and prevalence	No. positive and prevalence	Overall prevalence
Demodex	12 (5.94%)	-	12(3.12%)
Psoroptes	1 (0.49%)	4 (2.19%)	5(1.30%)
Total	13(6.43%)	4 (2.19%)	17(4.42%)

Table 6: Risk factor association with mange mite infestation in cattle and sheep

	Species							
	Bovine (n=202)				Ovine (n=182)			
Variable	Total	Positive (%)	P^2 (P-value)	OR(95% CI)	Total	Positive (%)	P^2 (P-value)	OR(95% CI)
Sex			0.3207(0.571)				0.163(0.686)	
Male	153	9(5.88)		1	89	2 (2.25)		1
Female	49	4(8.16)		1.4(0.4- 4.8)	93	3(3.23)		1.45(0.2-8.9)
Age			14.007(0.000)				3.834(0.040)	
Young	42	8(19.05)		7.3(2.2-23.7)	46	3(6.52)		4.7(1.7-8.9)
Adult	160	5(3.13)		1	136	2(1.47)		1
Body condition			7.745(0.021)				2.623(0.105)	
Good	84	0(0.0)		1	101	1(0.99)		1
Medium	80	3(3.75)		1.2 (0.2-1.8)	-	-		-
Poor	38	10(26.31)		3.99(1.3-12.5)	81	4(4.94)		0.2(0.02-1.7)
Breed			2.322 (0.128)					
Local	170	9(5.29)		1	-	-	-	-
Cross	32	4(12.5)		2.55(0.7-8.8)	-	-	-	-
Production system				0.253(0.615)				0.899(0.343)
Intensive	59	3(5.08)		1	41	2(4.88)		1
Extensive	143	10(6.99)		1.4(0.37-5.3)	141	3(2.13)		0.4(0.06-2.6)

respectively. However, the only mange mite species encountered in sheep was psoroptes with prevalence rate of 2.19% (Table 5). As shown in table 6, age in cattle (P^2=14.007; P=0.000) and in sheep (P^2=3.834; P=0.040) and body condition in cattle (P^2=7.745; P=0.021) were found statistically significantly associated with the prevalence mange mite infestation. However, sex, breed and management were not statistically significant (P>0.05). Young cattle and sheep were 7.3 times (OR=7.3; 95% CI: 2.2-23.7) and OR 4.7; 95% CI: 1.7-8.9) more susceptible to mange infestation than adult cattle and sheep, respectively. Similarly, poor body conditioned cattle were found around 4 times (OR= 3.99; 95% CI: 1.3-12.5) more likely infested with mange mite than good conditioned cattle.

DISCUSSION

The present study revealed that skin diseases caused by ectoparasites were common in and around Bishofitu in cattle and sheep. The overall prevalence of ectoparasites in cattle was 47.03%, which was in agreement with the prevalence (40.16%) reported by Yacob *et al.* [16] in Mekelle, northern Ethiopia. It was much higher than the prevalence (13.18%) reported by Yacob *et al*. [18] in Adama, central Ethiopia. On the other hand, 40.11% sheep were infested with one or more ectoparasites, which was higher than the prevalence reported (23.8%) from the Sidama Zone in Southern Ethiopia [26]. However, slightly lower than the ectoparasites prevalence reported (55.7%) in sheep and goat in WolaytaSoddo (Southern Ethiopia) by yacb *et al*. [27]. Chanie *et al*. [19] also reported that an overall 81.50% infestation of sheep with one or more types of ectoparasites in Ethiopia. This relatively higher prevalence of ectoparasites of the previous reports may be associated with different herd and flocks of animals coming in close contact at available communal watering and grazing sites because of the feed scarcity. The prevailing poor veterinary services, improper application of acaricides by non-professionals could also amplify this endemic situation were reported by yacob *et al.* [27].

In this study 71(35.15%) cattle and 49 (26.92%) sheep were infested with one or more genera of ticks, respectively. The current prevalence of tick infestation in sheep was consistent with the finding of Yacob *et al*. [27] who reported 31.78% in Wolitaseddo, whereas Zelalem [28] and Yacob *et al*. [16] observed very higher tick prevalences of 65.6% and 53.23% in the Dire Dawa region (Eastern Ethiopia)and in Mekelle, respectively. This difference might be due to difference agro-ecology and, management difference.

Prevalence of tick infestation was found significantly varied among sex both in cattle and sheep. Higher prevalence of tick infestation was observed in female than male both in cattle and sheep. This could be due to continuous production stress such as pregnancy and lactation which mightcompromise their immune status and eventually could not efficiently get rid of tick. The higher susceptibility of females towards tick infestationwere evidenced in the WolytaSoddo, Southern Ethiopia [27] but a contrary report was recorded in Adama, central Ethiopia [18]. Similarly, prevalence of tick infestation was significantly varied among production system in both species. Cattle and sheep managed under extensive management system were more likely at risk to be infested by ticks than that of cattle and sheep kept under intensive type of production, respectively. It was in agreement with Yacob *et al*. [16]. This might be due to management problems in the extensive production system where the housing, feeding and control measures and poor application of acaricides than in the intensive production system.

In present study, the identified tick's genera in cattle and sheep were *Boophilus*, *Amblyomma*, *Rhepicephalus*and *Hyalomma*. Of these, higher proportion of *Amblyomma* (67.6%) and *Boophilus* (32.39%) were observed in cattle. Similarly, higher proportion of *Amblyomma* (48.98%) and *Rhipicephalus* (46.97%) were isolated from 49 cases of sheep. Similarly, Chalachew (2001) also identified these tick genera in WolytaSoddo southern Ethiopia with higher proportion of *Amblyomma* (42.86%). Furthermore, these genera are known to be widely distributed in Ethiopia and heavily parasitize livestock [27].

The overall prevalence of pediculosis was 1.64% in sheep and 8.91% in cattle. Slightly higher prevalence (6.63%) in sheep and lower prevalence (3.94%) in cattle were reported by Yacob *et al*. [27] in Adama town. The present prevalence of pediculosis in sheep was in harmony with the prevalence reported in sheep (2.0%) by Haffize [29] in central Ethiopia. However, higher prevalence of pediculosis was reported in sheep (25.70%) [27] from Woliatasoddo and 53.23% in cattle from Mekelle [16]. The differences in the environmental conditions (study season and design) could have contributed for this variation. According to the present study, two genus of louse were identified in cattle and sheep (*Linognathus* and *Damalina*). Yacob *et al*. [16] was isolated *Linognathus* and *Damalina*from cattle, which was consistent with the present findings.

In this work, it was noticed that female cattle were significantly affected than male cattle (24.5% vs. 3.92%). This could be due to the weakness of pregnant and lactating females which could not efficiently get rid of ectoparasites and particularly of lice. This finding agreed with finding of Yacob *et al*. [27] but disagreed with the finding [16, 18, 30]. Similarly, cross breed cattle were 3 times higher at risk for tick infestation than indigenous local cattle breed. Genetically improved cattle might suffer more severely from malnutrition, production stress and poor housing systems in tropical countries and consequently become more susceptible to infestation [31].

Animals managed under extensive management system were more likely at risk with lice infestation than animals managed under intensive management system. This is in agreement with the work of Surafel [14], which could be due to the fact in the extensive production system animals are under poor feeding condition and hence are highly susceptible to lice infestation [31]. Moreover, most animals are kept together having a chance of direct physical contact contributing to fast transmission and maintenance of lice. Lice are transmitted by direct physical contact [32, 33]. Animals reared under intensive production system are less affected than extensive system. Furthermore, in intensive production system the management practiced in terms of regular spraying of acaricides, housing system and the feeding system is much better than extensive production system.

The overall prevalence of mange mite infestation was 4.42%. The prevalence of demodicosisand psoroptic mange in cattle was 5.94% and 0.94%, respectively. However, the only mange mite species encountered in sheep was psoroptes with prevalence rate of 2.19%. Variable results were reported from different part of Ethiopia with prevalence of 1.88% in cattle, 1.33% in sheep and 1.02% in goats from Adama town [18], 1.63% in cattle from WolaytaSoddo [34] and 0.42% from Nekemte [30]. The prevalence of mange mite infestation was found significantly higher in young than adult in both species. The probable explanation is that young cattle are more prone to mange infestation due to under developed immunity status as compared to the adult animals. The prevalence of mange was significantly higher in poor body conditioned cattle (26.31%) than medium (3.75) and good body conditioned (0.0%) cattle. Kumsa and Bekelle [35] indicated that ectoparasites infestation is common in malnutritioned, stressed and diseased cattle than well fed, healthy and good body conditioned animals. Malnutrition and chronic diseases may lower the immunity of the animal and subsequently results in infestations with mange mites.

CONCLUSION

The present study revealed that widespread occurrence of ectoparasites in cattle and sheep in and aroundBishofitu. The major ectoparasites identified were tick, lice and mange mite. Tick infestations were caused by *Amblyomma, Boophilus, Rhepicephalus*and *Hyalomma. Damalina*and *Linognathus* were the prevailing cause of pediculosis. *Demodex and psoroptes* was responsible agent of mange mite infestations in the study area. Tick and lice infestation were found higher in extensive production system than intensive type of production. Mange mite infestation was higher in young and poor conditioned animals. Favorable climatic conditions, backward level of management, poor level of consciousness and awareness of farmers and weak animal health extension services are believed to have contributed for widespread distribution and occurrences of ectoparasites. As ectoparasites are the major causes of skin/hide downgrading and rejection in tanneries, reduce livestock productivity and vector of various diseases incurring economic losses.

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