

Prevalence of Ectoparasites on Small Ruminants Around Kombolcha, North East Ethiopia

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Abstract: The study was conducted around Kombolcha, south wollo, north east Ethiopia from November 2007 to April 2008 to determine the extent of ectoparasite problem in small ruminants. A total of 1638 (685 sheep and 983 goats) were examined for the presence of skin lesion that is indicative of ectoparasites. The relation between prevalence rate of ectoparasites in relation to species, sex and age was determined. Different species of ectoparasites were identified in both sexes and different age groups in sheep and goats. Out of these examined animals 460 (190 sheep and 270 goats) were found with skin lesion of a total 190 sheep with skin lesion 88.4% were positive for one or more species of ectoparasites which out 270 goats with skin lesion 100% were infested with various ectoparasites. The major ectoparasites prevailing in the area and registered in this study were mange 2.7% in sheep and 5.7 in goats, tick 7.35 in sheep and 13.7% in goats, lice 21.7% in sheep and 34% in goats and flea 7.3% in sheep and 8.2% in goats. There was no significant ($p>0.05$) difference in the prevalence rate of all the ectoparasites infestation between sheep and goats although higher infestation rate was found in goats than sheep in all ectoparasites. The prevalence rate of mange in goats and lice and flea in sheep was significantly ($p<0.05$) associated with age. No statistically significant ($p>0.05$) difference in the prevalence of all the ectoparasites between male and female. Based on the questionnaire summery 126 (84%) of the 150 respondents considered ectoparasite as an important problem in small ruminant production in the study area. Out of which 107(71.3%) were found to know problems caused by ectoparasites, 66(44%) have knowledge on seasonal occurrence of ectoparasites and 124 (827%) were found to explain made of transmission of ectoparasites. Based on the findings, effort should be made to control ectoparasites so as to ensure quality of skin and prevent economic loss attributable to skin lesions.

Key words: Age • Sex • Sheep and Goats • Skin lesions • Species

INTRODUCTION

Livestock in Ethiopia is an essential component of the overall farming system. They serve as source of draught power for the largest majority of the rural population, supply farm families with milk, meat manure and serve as source of income from sale of livestock and their products. In addition, livestock contribute to the national economy through the export of live animals, meat, hides and skin [1]. Sheep and goats constitute of significant proportion of the livestock resources of Ethiopia. On the national level, because of the huge potential of the small ruminants, the country possesses, Ethiopia drives an appreciable proportion of its total

export earnings from the trade of small ruminant products particularly skins. The country is capable of supplying 16-18 million skin and hides per year for the domestic tanneries [2]. The Ethiopian skin specifically the sheep skin is known in the world market for the production of first leather in terms of its fine gain a compact structure. This nature receives the biggest attraction for a number of leather productions in the world [3].

Ethiopia earned 372.3, 347.7 and 234.7 million ETB from export of leather and leather products in 1996/97, 1997/98 and 1998/99 fiscal year, respectively. This figure represents 14-17% of the total export earning over the years [4]. This percentage would have gone far higher if not presence of skin diseases that affected over 30% of

the processed skins annually. As many as one quarter to one third of all skin and hides processed at tanneries are unsuitable for export due to various defects. Sixty five percent of these defects are said to occur in the pre-slaughter stage of production which are directly related to skin diseases [5]. In addition to down grading and condemnation of skin, skin diseases impose economic losses as a result of reduction of wool quality, losses due to culling and occasional mortalities and losses associated with treatment and prevention of the diseases [6-8]. Of these skin diseases, ectoparasites take more of the proportion of economic losses in Ethiopia [9]. The most common ectoparasites that cause major economic losses are, mange mites, ticks, lice, sheep kids; myiasis, fleas, etc [10]. The economic losses caused by ectoparasites of small ruminants need detailed investigation on their distribution to devise strategies for control and prevention. Therefore it is always necessary to identify the ectoparasites involved in down grading of skin quality in order to ensure that they are the primary cause of the damage and hence design control measures [11]. There were some studies carried out on ectoparasites of small ruminants in different parts of Ethiopia. Some control measures have also been implemented in certain parts of Ethiopia [12-14]. Reliable and current information is needed to reinforce the control programs and monitor the progress of such activities. Hence the species composition and distribution of these parasites is crucial. Thus, the objectives of this study were to identify the major ectoparasites of sheep and goats and determine their prevalence in the study area.

MATERIALS AND METHODS

Study Area: The study was conducted in Harbu, Kombolcha and Degan areas of Kalu district, South Wollo, Ethiopia from November 2007 to April 2008. Kalu is found 275km north east of Addis Ababa. The altitude of the area is 1925 meters above sea level. The topography of the area is marked by the presence of numerous mountains, plateaus, hilly and sloppy areas, rivers and lakes. The study area is generally categorized as 14% highland, 34% midland and 52% lowland. The area has bimodal rainfall pattern: the short and long rains with 39.63mm and 1000mm, respectively. The minimum and maximum mean annual rain fall ranges from 1.2mm to 320.7mm. The average minimum and maximum daily temperature during short and long rains are 3.4°C and 32.5°C, respectively. Relative humidity of the region varies from 21 to 88% [15].

Animals: The animals included in this study were indigenous breeds of sheep and goats of both sexes and all age groups. Age determination was made according to Aiello and May [16]. Lambs and kids of 6 months of age and less were considered as “young” while those which are above 6 months were taken as “adult”. A total of 1638 small ruminants (953 goats and 685 sheep) that were brought to Kalu veterinary clinics were included in the study. Three clinics namely Kombolcha, Harbu and Degan were randomly selected for this study. The sample size was determined according to Thrusfield [17] considering 4% prevalence, 5% accepted error at 95% confidence level. The sample size required was 384 but in order to increase precision 1638 animals were studied. These include 604, 462 and 572 sheep and goats from Kombolcha, Harbu and Degan, respectively.

Study Design and Methodology: Examination was made through visual inspection and palpation to detect the presence of skin lesions. Skin samples were collected from the animals showing skin lesions after proper restraining. For the examination of mange mites, skin scrapings from the suspected cases were taken from multiple sites and made until capillary blood oozes. The periphery of active lesion was selected to take the samples. Fresh or preserved specimens were placed in Petri dish and treated by 10% KOH as previously described by Soulsby [18]. The specimens were transferred to clean slides, covered with cover slip and examined for the presence of mites at 100x magnification. The species or genus of the mites encountered was identified based on their morphology. Deep scrapping of pustules and abscess and squash smear of their contents were examined for the presence of demodectic mites at 100x magnification of the microscope [19].

Other ectoparasites encountered either on the skin surface or attached to the hair were also sampled or preserved in 70% ethanol. For this lice were collected by combing of hair. Further identification of the species of lice observed was conducted in the laboratory according to methods described by Soulsby [18]. Ticks were collected from their attachment sites by gentle rotation in order not to damage the mouth parts. Classification of the type of ticks encountered was performed based on their morphological features such as ornamentation scutum, festoons, eye and shape of basis capitulum, palps and others as described by Soulsby [18]. Fleas were collected after rubbing of the infested area by clean towels moistened with ethanol or water. Identification of their genus or species was

made based on differentiating structures that include width and length of head, combs and spines on the head or legs.

Data Analysis: Prevalence was defined as the proportion of number of small ruminants positive for ectoparasites to the total number of small ruminants sampled, which was expressed in percent. Variation of prevalence between species, age and sex groups was analyzed by Pearson's chi-square at 95% confidence level. Statistical significance was considered when P-value was less than 0.05 [20].

RESULTS

A total of 1638 animals (685 sheep and 953 goats) were examined for the presence of skin lesions suspected to be caused by ectoparasites. Of these 460 (28 %) animals (190 sheep and 270 goats) were found to have one or more types of skin lesions. From those animals with skin lesions 438 (95%) were positive for ectoparasites. From the total of 1638 animals examined for the presence of skin lesions, the overall prevalence of ectoparasite was 26.74%. The prevalence was 10.3% in sheep and 16.5% in goats. Of a total of 190 sheep with skin lesions, 168 (88.4%) were positive for one or more species of ectoparasites while out of 270 goats with skin lesions 100% of them were infested by various ectoparasites. Over all 9 (2.1%) of sheep and 25 (5.7%) of goats were infested by mange mites; 32 (7.3%) of sheep and 60 (13.7%) of goats were infested by ticks; 95 (21.7%) of

sheep and 149 (34%) of goats were infested by lice and 32 (7.3%) of sheep and 36 (8.2%) of goats were infested by fleas (Table 1). In both sheep and goats lice were the most prevalent while mange mites were least prevalent.

The overall prevalence of skin lesions was 28.5% (125/604), 32.1% (141/462) and 39.3% (172/572) in Kombolcha, Harbu and Degan, respectively. Of these 8.8%, 6.38% and 8.13% were infested by mange, 33.6%, 24.11% and 9.3% were infested with ticks, 36.8%, 65.9% and 59.9% were infested by lice and 20.8%, 2.12% and 22.7% were infested by fleas in Kombolcha, Harbu and Degan, respectively (Table 2).

Statistical analysis has shown that no significant difference exists between prevalence of ticks, mange mites, lice and fleas and species of study animals ($P > 0.05$). However, there was relatively higher prevalence of infection in goats than in sheep for all parasites. The present study has shown that *Sarcoptes scabiei*, *Psoroptes ovis*, *Demodex ovis* and *Demodex caprae* were the common mange mites in the study area (Table 3). They were observed with prevalence of 1.2 % *Sarcoptes*, 3.57% *Psoroptes* and 4.16% *Demodex* in sheep and 6.66% *Sarcoptes* and 3.33% *Demodex* in goats. No *Psoroptes* was found infesting goats in the area. In both sheep and goats significant ($P < 0.05$) difference was observed in the prevalence of mange between young and adult ones. The prevalence was higher in adults than in younger animals. *Sarcoptes* was the dominant mange in goats but not in sheep.

Table 1: Prevalence of ectoparasites in sheep and goats according to age and sex

Animal species	Age/sex group	Mange	No. (%) of animals positive for		
			Tick	Lice	Flea
Sheep (n=168)	Y(n=44) A(n=124)	0(0%)	6(13.6%)	24(54.5%)	14(32%)
	M(n=74)	9(7.3%)	26(21%)	71(57%)	18(14.5%)
	F (n=94)	6(8.1 %)	11(14.9%)	46(62.2%)	11(15%)
Over all	168	3(3.2%)	21(22.3%)	49(52%)	21(22.3%)
		9(5.4%)	32(19%)	95(56.5%)	32(19%)
Goat (n= 270)	Y(n=72)	0(0%)	13(18.1%)	45(62.5%)	14(19.4%)
	A(n=198)	25(12.6%)	47(23.7%)	104(52.5%)	22(11.1%)
	M(n=129)	13(10.1%)	29(22.5%)	67(52%)	20(15.5%)
	F(n=141)	12(8.5%)	31(22%)	82(58.2%)	16(11.3%)
Over all	270	25(9.3%)	60(35.7%)	149(88.7%)	36(21.4%)
Grand Total	438	34(7.8%)	92(21%)	244(55.7%)	68(15.5%)

Key: n=number of animals positive F=female M=male Y=young A=adult

Table 2: Prevalence of skin lesions and ectoparasites in selected villages of Kalu district

Site	Skin lesion	Mange	Ticks	Lice	Fleas
Kombolcha	125(28.5%)	11(8.8%)	42(33.6%)	46(36.8%)	26(20.8%)
Harbu	141(32.1%)	9(6.38%)	34(24.11%)	93(65.9%)	3(2.12%)
Degan	172(39.3%)	14(8.13%)	16(9.3%)	103(59.9%)	39(22.7%)

Table 3: Prevalence of mange infestation in sheep and goats from Kalu district

Species	Sex/Age	No. (%) positive for			Total
		Sarcoptes	Psoroptes	Demodex	
Goat (n= 270)	y (n=72)	0(0%)	0	0	0
	A (n=198)	18(7.6%)	0	9(4.5%)	27(13.6%)
	M(n=129)	9(7%)	0	4(3.2%)	13(10.1%)
	F (n=141)	6(4.3%)	0	6(4.3%)	12(8.6%)
Sheep (n=168)	y(n=44)	0(0%)	0(0%)	0(0%)	0
	A(n=124)	1(0.81%)	4(3.2%)	4(3.2%)	9(7.2%)
	M(n=74)	1(1.6%)	2(2.7%)	3(4.1%)	6(8.4%)
	F(n=94)	0(0%)	2(2.1%)	1(1.1%)	3(3.2%)

Table 4: Tick infestation prevalence in sheep and goats from Kalu district

Animal species	Sex/Age group	No. (%) positive for			Total
		Amblyoma	Rhipicephalus	Boophilus	
Goat (n= 270)	y (n=72)	11(15.3%)	2(2.8%)	3(4.2%)	16(22.3%)
	A (n=198)	26(13.1%)	9(4.5%)	9(4.5%)	44(22.1%)
	M(n=129)	17(13.2%)	6(4.7%)	7(5.4%)	30(23.3%)
	F (n=141)	20(14.2%)	5(3.5%)	5(3.5%)	30(21.2%)
Sheep (n=168)	y(n=44)	1(2.3%)	2(4.5%)	7(16%)	10(22.8%)
	A(n=124)	3(2.4%)	5(34%)	13(10.5%)	21(16.9%)
	M(n=74)	3(4.1%)	1(1.4%)	7(9.5%)	11(15%)
	F(n=94)	1(1.1%)	6(6.4%)	13(13.8%)	20(21.3%)

Table 5: Prevalence of lice infestation in sheep and goats from Kalu district

Animal species	Sex/Age group	No. (%) positive for		Total
		Linognathus	Damalina	
Goat (n= 270)	y (n=72)	43(59.7%)	2(2.8%)	45(62.5%)
	A (n=198)	103(52%)	1(0.51%)	104(52.51%)
	M(n=129)	65(50.4%)	2(1.6%)	67(52%)
	F (n=141)	81(57.4%)	1(0.71%)	82(58.1%)
Sheep (n=168)	y(n=44)	21(47.7%)	2(4.5%)	24 (54.5%)
	A(n=124)	55(44.4%)	5(34%)	71(57.4%)
	M(n=74)	35(47.3%)	1(1.4%)	46(62.3%)
	F(n=94)	41(43.6%)	6(6.4%)	49(53.1%)

Table 6: Prevalence of fleas infestation in sheep and goats in Kalu district

Animal species	Sex/Age group	No. (%) positive for		Total
		Ctenocephalides canis	Ctenocephalides felis	
Goat (n= 270)	y (n=72)	9(12.5%)	5(6.9%)	14(19.4%)
	A (n=198)	14(7.1%)	8(4%)	22(11.1%)
	M(n=129)	12(9.3%)	8(6.2%)	20(15.5%)
	F (n=141)	11(7.8%)	5(3.5%)	16(11.3%)
Sheep (n=168)	y(n=44)	5(11.4%)	9(20.5%)	14(31.9%)
	A(n=124)	8(6.5%)	10(8.1%)	18(14.6%)
	M(n=74)	5(6.8%)	6(8.1%)	11(14.9%)
	F(n=94)	8(8.5%)	13(13.8%)	21(22.3%)

Key: n = No. of animal positive Y = young A= adult M= male F = Female

The genera of tick identified on small ruminants during this study were *Amblyoma*, *Rhipicephalus* and *Boophilus* with prevalence of 2.4%, 4.16%, 11.9% and 13.7%, 4.0%, 4.4% in sheep and goats, respectively (Table 4). *Amblyoma* was the most prevalent in goats while *Boophilus* was most abundant in sheep.

Linognathus africanus was the predominant lice encountered in the study areas in both species of study animals followed by *Damalina ovis* and *Damalina caprae*. The prevalence of *Linognathus* was 54.07% and 45.23% in goats and sheep, respectively. *Damalina ovis* was observed with prevalence of 4.16% while *Damalina caprae* was encountered with prevalence of 1.11% (Table 5).

Fleas were also found infesting small ruminants in the present study (Table 6). Two flea species (*C. canis* and *C. felis*) were encountered with prevalence of 8.51% and 4.81%, respectively in goats and 7.73% and 11.3%, respectively in sheep.

DISCUSSION

This study has shown that ectoparasites are causing problems in small ruminant production in the study area. The most common ectoparasites were mange, tick, lice and fleas. One or more of these ectoparasites were recorded in 168 (10.3%) of sheep and 270 (16.5%) of goats, respectively. Of all animals with skin lesion 88.4% of sheep and 100% of goats were found to harbor one or more ectoparasite types. Lice were found to be the most prevalent ectoparasites followed by ticks in both animal species. This shows that lice were the predominant cause of skin lesion in the area. The present study in general revealed that ectoparasites are the most important causes of skin infection and damage. Since skin and hides is important export commodity for Ethiopia ectoparasites are among serious causes of economic losses through downgrading of skins.

The prevalence of mange due to one or more genera of mange mite was 5.7% in goats and 2.1% in sheep. This result is comparable to the prevalence of 4.27% in goats and 2.07% in sheep from Sidama zone [21], 3.96% in goats and 2.63% in sheep from central Ethiopia [22], 6.87 % in goats from Wolayta [9] and 1.56% in sheep from Mekele [23]. But our result showed prevalence that is lower than the prevalence of 33.27% reported in goats by Numery [12] from Kombolcha. This difference could be probably due to strategic control program being taken at the study area to minimize prevalence of ectoparasites in small ruminants. Retrospective data collected during the last five years and recorded by Kalu district veterinary

clinics showed that there was high prevalence of mange infestation before commencement of the control program. This control measures which is thought to bring reduction in the prevalence of infestation. In this study there was no significant difference in the prevalence rate of mange among sheep and goats. However there was higher percentage of infestation in goats (5.7%) than in sheep (2.1%). This result is in agreement with the reports of Teshome [21] from Sidama zone.

Three genera of mange (*Sarcoptes*, *Psoroptes* and *Demodex*) were identified in this study. Of the mange mites affecting sheep and goats in the study area, *Sarcoptes* was found to be the most prevalent in goats. In the current study 47.1% (16 out of 34) mange mites identified were *Sarcoptes scabiei*. This is in support of previous report made by Sherman [2] who found *Sarcoptes scabiei* to be the most prevalent species in Ethiopia. Our result further agrees with the reports of Chalachew [9], Gashaw [24] and Falconi *et al.* [25]. The prevalence of psoroptic mange was 2.4% in sheep and nil in goats. Our result showed that *Psoroptes ovis* was the dominant mange in sheep. This finding fairly agrees with the reports of Teshome [21] who has observed prevalence of 1.53% in sheep and 0.95% in goats from Sidama zone and that of Chalachew [9] who found no *Psorotes* in these animals from Wolayta. The dominance of *Sarcoptes* in goats and *Psoroptes* in sheep in this study supports the previous observation published from various parts of the world. For example, Gabaj *et al.* [26] recoded that Libyan sheep and goats were predominantly infested with *Psoroptes* and *Sarcoptes* respectively, Bates [27] reported prevalence of *Psoroptes* to be 1.4% in sheep and nil in goats from UK. *Psoroptes ovis* has been known to cause sheep scab which is a disease of economic and welfare importance in sheep flocks throughout the world.

Demodicosis was found with prevalence of 3.7% in goats and 2.4% in sheep. This result is comparable with the prevalence of 1.33% in sheep and 1.02% in goats from Adama [28]; 0.8 % in sheep and 1.37% in goats from central Ethiopia [22]; 0.84% in sheep and 0.99% in goats from Eastern Ethiopia [24], 3.5% in goats and 0.88% in sheep from southern rangelands of Oromyia [29]. In both species of animals significantly higher prevalence was observed in adults than in younger ones. This finding contradicts the previous reports that support that younger animals are more susceptible to ectoparasites than their adult counter parts [30]. The difference could be attributed to difference in the overall prevalence of demodicosis, sample size and climatic conditions of the study areas.

The overall prevalence of tick in this study was 7.35% in sheep and 13.7% in goats. Three genera of ticks (*Amblyoma*, *Boophilus* and *Rhipicephalus*) were identified from both sheep and goats. This is in support of previous reports of Mekonnen [31] who has shown that these three tick genera were predominant in livestock of Ethiopia. The prevalence of ticks infestation in sheep was, *Amblyoma* species (0.91%), *Boophilus* species (4.6%) and *Rhipicephalus* (1.6%) whereas in goats, *Amblyoma* species (8.4%), *Boophilus* species (2.7%) and *Rhipicephalus* (2.5%). Previously some investigators found similar prevalence for ticks in small ruminants specially that of *Amblyoma* in different parts of Ethiopia [12, 21]. Comparable results have also been published from Nigeria [32]. In contrast higher prevalence was observed in Iranian sheep and goats [33]. The difference could be due to difference in agro-ecology management practices. In the current study areas there has been regular application of ectoparasiticide drugs since there was ectoparasite control since the last five years.

The overall prevalence of lice infestation was 21.7% in sheep and 34% in goats. But of those animals which have skin lesions 56.5% of sheep and 88.7% of goats were positive for lice. A comparable prevalence (23.5%) in sheep and lower (18%) in goats was reported from Sidama zone [21]. The overall prevalence is lower than that Mohammad and Ali [34] who reported prevalence of 67.5% and 71.4% in sheep and goats, respectively. But our result is higher than the prevalence recorded in Nigerian sheep and goats [32]. Lice infestation was observed to affect most animals in the flocks of sheep and herd of goats. This showed that close contact between animals is important in the transmission of the parasite. Three Species of lice (*Linognathus africanus*, *Damalina ovis* and *Damalina caprae*) were identified from both sheep and goats. The prevalence of lice infestation was; *Linognathus* species 17.35% in sheep and 33.3% in goats whereas *Damalina* specie 4.3% in sheep and 0.68% in goats. A comparable results; *Linognathus* species 10.5% in sheep but lower (18.3%) in goats were reported from Sidama zone [21]. Similarly the predominance of *Linognathus* was observed in Iranian sheep and goats [33]. *Linognathus* and *Damalina* specie cause defects that appear on the grain side of semi-processed skin after pickling that is not detected when the skin is examined in its raw or in live animals [11, 12].

In this Study Two Flea Species: *Ctenocephalides canis* and *Ctenocephalides felis*. *C. canis* was more abundant in small ruminants of the area than *C. felis*. There are

studies have addressed the seasonally peaks of flea infestation. The overall prevalence of flea infestation was 7.3% in sheep and 8.2% in goats. This goes in line that of Numery [12] who has reported prevalence of 5.60% in goats from the same area. *C. canis* and *C. felis* were observed with prevalence of 19.4% and 21.4% among those sheep and goats, respectively which have skin lesions. Fleas are generally not considered to be important ectoparasites of livestock; however, this may not be true particularly when livestock live in close association with farm cats and dogs [34, 35]. Cat flea *C. felis* is amongst the most important ectoparasites of ruminants in Israel [36].

CONCLUSION

The present study revealed that significant proportion of small ruminants had skin lesions that are likely to cause downgrading of skin quality and rejection during processing. Ninety five percent of these animals with skin lesions were found to harbor one or more ectoparasite species signifying their role in causing skin damage.

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