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Prevalence and Identification of Ectoparasites Fauna in Small Ruminants in Selected Areas of Eastern Ethiopia

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Abstract: This study was employed to determine the prevalence and species of ectoparasites in small ruminants in selected areas of eastern Ethiopia. Physical examinations were undergone in 883 animals (490 goats and 393 sheep) and laboratory identification was employed on the ectoparasites. Overall ectoparasites prevalence of 47.5 % (419/883) recorded, in which goats and sheep were infested with the prevalence of 51.4% and 42.2 %, respectively. Totally ten species of tick, two species of lice, three species of mite and one flea genus were registered. Among the tick species *Rhipicephalus pravus* (12%) followed by *Rhipicephalus pulchellus* (6.8%), in goats and *Rhipicephalus praetextatus* (6.4%) followed by *Ambloyommaa variegatum* (5.1%), in sheep were the most prevalent. Most of the ticks have significantly ($p<0.05$) higher prevalence in animals with poor body condition. *Bovicola ovis* was the only lice found in sheep, whereas *Linognathus africanus* was encountered in goats. *Linognathus* species have significantly ($p<0.05$) higher prevalence in goats with poor body condition. *Ctenocephalides* fleas were also found in both sheep and goats having significantly ($p<0.05$) higher prevalence in goat than sheep and young age of both sheep and goats. *Demodex* mites were found in both sheep and goats, while *Psoroptes cuniculi* was found only in goats. In goats, prevalence of mite was significantly ($p<0.05$) higher in animals with poor body condition than the other categories. The study indicate that small ruminants in the study area were infested with numerous ectopaarsites fauna and hence coordinated effort to reduce the impact is imperative.

Key words: Fleas · Lice · Mites · Ticks · Sheep and Goats

INTRODUCTION

The livestock share of agricultural output in Ethiopia is about 40%, which made it an important sector for Ethiopia's economy providing a significant contribution to the GDP [1]. Particularly, the small ruminants are important contributors to food production in the country, providing 35% of meat consumption and 14% of milk consumption. These are possible due to their high fertility rate, short generation interval and even adaptation in harsh environment [2]. Moreover, small ruminants provides the country with export commodities such as live animals and skins to earn foreign exchange, in fact the sheep and goat skins rank among the largest export commodities [3, 4].

Unfortunately, the different skin diseases of small ruminants in Ethiopia are accountable for considerable economic losses especially to the skin and hide export due to various defects [5]. The important external parasites which cause noticeable lesion in the skin coat include ticks, lice, fleas and mange mites [6, 7]. Ticks can cause mechanical damage, anemia, toxicity and paralysis in severe infestation [8]. It can also act vector for diseases like Babesia and Anaplasma [9]. In Ethiopia tick and tick born disease ranked third after trypanosomiasis and endoparasitism in causing economic loss [10]. Lice cause cutaneous and systemic effect on hosts, including dermatitis and anemia in case of high infestation [11]. Fleas also inflict inflammation and pruritus [9]. On the other hand, mite causes intense

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pruritus, crusts, excoriation and lichenification in the body of the animal, which in turn affect the quality of hide and skin greatly [12]. Therefore, the objective of this study is to determine the prevalence of ectoparasites and identify species of ectoparasite found in parts of eastern Ethiopia.

MATERIALS AND METHODS

Study Area: The study was carried out in five selected areas of eastern Ethiopia including Jijiga, Erer, Dire Dawa, Haramaya and Harar areas. The agro-ecology is mid land and low land with pastoralist, agro-pastoralist and mixed farming practice across the study areas.

Study Design: A cross-sectional study was conducted from November 2013 to April 2014 to determine the prevalence and species of external parasites in the study areas. The considered explanatory variables were species, age, sex and body condition of local breed small ruminants which are raised under extensive and backyard system in the study areas.

Sampling and Sample Size Determination: The areas in the study area were selected purposively, based on accessibility, livestock population and willingness of the owners. Sample size of small ruminants was determined according Thrusfield [13] and a total sample of 883 small ruminants was selected randomly from the household.

Study Methodology: The physical condition of animals was registered as good, medium and poor according to Nicholson and Butterworth [14] whereas, the age of animals was determined as young and adult based on Girma and Alemu [5]. Examination for ectoparsites and related lesions was undergone by multiple fleeces parting in opposite direction to hair or wool normally rests. Ticks, lice and fleas were collected manually from their attachment site, while skin scrape for mite was carried out and processed according to Wall and Shearer [9]. Tick species identification was based on Walker *et al.* [8] description and lice, fleas and mites identification was according to Wall and Shearer [9]. Ectoparasite samples were preserved in70% alcohol in universal bottles Taylor *et al.* [15], until subsequent laboratory examination at Haramaya University Veterinary parasitology laboratory.

Data Management and Analysis: The data was entered into Microsoft excel and Statistical Package for Social Science, version 20 was used to analyze the data. Chi-square (χ^2) test was employed to determine the association between prevalence and independent variables at 95% confidence interval and P value of 0.05.

RESULT

In the present study, small ruminants were infested with overall prevalence of 47.5% in both single and mixed infestation. Tick, fleas and mites were presented significantly ($P<0.05$) higher in goats, while lice were encountered more frequently in sheep ($P<0.05$) (Table 1). *Rhipicephalus pravus* and *Hyalomma impeltatum* ticks were predominant ($p<0.05$) in goats. *Bovicola ovis* (21.4%)w as identified from sheep and *Linognathus africanus* (7.1%) was identified from goats (Table 2). Fleas infestation in goats were significantly ($p<0.05$) higher than the sheep. Three mite species which belong to the *Demodex* and *Psoroptes* genera were recorded from the small ruminants (Table 1).

Most ticks have no statistically significant association with respect to sex. In most tick species there is no significant association with the age of animal with the exception of *Rhipicephalus pravus* and *Rhipicephalus pulchellus* which have significantly ($P<0.05$) higher prevalence in adult goats and *Rhipicephalus sanguineus* with significantly ($p<0.05$) higher prevalence in the young sheep (Table 3, Table 4). Most of the tick species have significantly ($P<0.05$) higher prevalence in poor body condition animal. *Linognathus africanus* has significantly ($P<0.05$) higher prevalence in goats with poor body condition while *Bovicola ovis* has no statistically significant association with respect to the sex, age and body condition of the sheep (Table 3, Table 4). Young small ruminants have significantly ($p<0.05$) higher flea infestation. Both *Demodex* and *Psoroptes* mites show significantly ($P<0.05$) higher prevalence in goats with poor body condition (Table 3 and Table 4).

In the present study ticks generally prefer the head area including the ear (Fig.1e), the eye (Fig. 1d) and oral region (Fig. 1a). But, ticks were also found in wide range of sites on the small ruminant's body including the neck, chest, leg, vulva, inter-digital space (Fig. 1c) and anal area (Fig. 1b). The lesions inflicted by the ticks were also various involving bleeding point, roughness, redness (Fig. 1f) or severe abscessive lesion during heavy infestation (Fig. 1d). *Demodex* mites inflicted abscessive nodular swellings, whereas the *Psoroptes cuniculi* causes leathery appearance and alopecia on the goats skin (Fig. 1g).

Table 1: The overall prevalence of external parasites within the small ruminants

External Parasites	Total	Species of animal		
		Goats (n=490)	Sheep (n=393)	χ^2(P-value)
Tick	271(30.7%)	176(35.9%)	95(24.2%)	14.144(.000)
Lice	119(13.5%)	35(7.1%)	84(21.4%)	37.878(.000)
Fleas	78(8.8%)	52(10.6%)	26(6.6%)	4.325(.042)
Mite	24(2.7%)	19(3.9%)	5(1.3%)	5.598(.021)
Over all	419(47.5%)	252(51.4%)	167(42.5%)	

Table 2: Distribution of ectoparasite species in sheep and goats, number in case and (prevalence in %)

Ectoparasites Species	Total	Goats (n= 490)	Sheep (n=393)	χ^2 (P-value)
A. variegatum	47 (5.3%)	27 (5.5%)	20 (5.1%)	.077(.880)
B. decoloratus	27 (3.1%)	19 (3.9%)	8 (2.0%)	2.496(.121)
R. praetextatus	54(6.1%)	29 (5.9%)	25 (6.4%)	.873(.646)
R. pulchellus	47(5.3%)	31(6.3%)	16(4.1%)	2.201(.174)
R. evertsievertsi	48(5.4%)	30(6.1%)	18(4.6%)	1.009(.371)
R. sanguineus	39 (4.4%)	24(4.9%)	15(3.8%)	.604(.511)
R. pravus	78 (8.8%)	62 (12.7%)	16 (4.1%)	19.944(.000)
H. truncatum	25 (2.8%)	17 (3.5%)	8 (2.0%)	1.630(.226)
H.anatolicumanatolicum	17 (1.9%)	11 (2.2%)	6 (1.5%)	.596(.473)
H. impeltatum	9 (1.0%)	8 (1.6%)	1 (0.3%)	4.106(.048)
B. ovis	85 (9.6%)	0 (0.0%)	84(21.4%)	112.349(.000)
L. Africanus	35(4.0%)	35(7.1%)	0(0.0%)	29.230(.000)
Ctenocephalides fleas	78 (8.8%)	52(10.6%)	26 (6.6%)	4.325(.042)
D. caprea	12(1.4%)	12(2.4%)	0(0.0%)	9.757(.001)
P. cuniculi	7(0.8%)	7 (1.4%)	0(0.0%)	5.659(.019)
D. ovis	5(0.6%)	0(0.0%)	5(1.3%)	6.270(.017)
Overall	419(47.5)	252 (51.4%)	167 (42.5%)	

Table 3: Distribution of ectoparasite species in goats based on sex, age and body condition scores, number in case and (prevalence in %)

Species of ectoparasite	Sex			Age			Body condition score			
	Male (n=178)	Female (n=312)	χ^2 (P-value)	Young (n=162)	Adult (n=328)	χ^2 (P-value)	Good (n=144)	Medium (n=203)	Poor (143)	χ^2 (P-value)
A. variegatum	11(6.2%)	16(5.1%)	.241(.682)	11(6.8%)	16(4.9%)	.761(.404)	5(3.5%)	13(6.4%)	9(6.3%)	1.629(.443)
B. decoloratus	9(5.1%)	10(3.2%)	1.042(.336)	7(4.3%)	12(3.7%)	.128(.804)	1(0.7%)	7(3.4%)	11(7.7%)	9.598(.008)
R. praetextatus	14(7.9%)	15(4.8%)	3.701(.157)	7(4.3%)	22(6.7%)	1.621(.445)	4(2.8%)	7(3.4%)	18(12.6%)	18.541(.001)
R. pulchellus	14(7.9%)	17(5.4%)	1.117(.336)	4(2.5%)	27(8.2%)	6.076(.016)	6(4.2%)	7(3.4%)	18(12.6%)	13.430(.001)
R.evertsievertsi	12(6.7%)	13(5.8%)	.186(.697)	8(4.9%)	22(6.7%)	.590(.550)	2(1.4%)	12(5.9%)	16(11.2%)	12.016(.002)
R. sanguineus	7(3.9%)	17(5.4%)	.559(.520)	8(4.9%)	16(4.9%)	.001(1.000)	1(0.7%)	10(4.9%)	13(9.1%)	10.860(.004)
R. pravus	15(8.4%)	47(15.1%)	4.517(.035)	12(7.4%)	50(15.2%)	6.026(.014)	7(4.9%)	24(11.8%)	31(21.7%)	18.577(.000)
H. truncatum	9(5.1%)	8(2.6%)	2.102(.198)	2(1.2%)	15(4.6%)	3.609(.067)	6(4.2%)	8(3.9%)	3(2.1%)	1.147(.564)
H. impeltatum	3(1.7%)	5(1.6%)	.005(1.000)	0(0.0%)	8(2.4%)	4.017(.057)	1(0.7%)	5(2.5%)	2(1.4%)	1.710(.425)
L. Africanus	9(5.1%)	26(8.3%)	1.835(.204)	11(6.8%)	24(7.3%)	.045(1.000)	1(0.7%)	5(2.5%)	29(20.3%)	52.938(.000)
D. caprea	3(1.7%)	9(2.9%)	.682(.549)	3(1.9%)	9(2.7%)	.361(.759)	0(0.0%)	0(0.0%)	12(8.4%)	29.850(.000)
P. cuniculi	3(1.7%)	4(1.3%)	.131(.708)	1(0.6%)	6(1.8%)	1.131(.434)	0(0.0%)	1(0.5%)	6(4.2%)	11.126(.004)
H. anatolicum. anatolicum	7(3.9%)	4(1.3%)	3.628(.108)	1(0.6%)	10(3.0%)	2.921(.111)	3(2.1%)	7(3.9%)	1(0.7%)	2.913(.233)
Ctenocephalides species	23(12.9%)	29(9.35%)	1.571(.224)	44(27.2%)	8(2.4%)	69.864(.00)	12(8.3%)	19(9.4%)	21(14.7%)	3.625(.163)
Over all	93 (52.25%)	159 (50.96%)		86 (53.09%)	166 (50.61%)		36 (25%)	82 (40.39%)	134 (93.71%)	

Table 4: Distribution of ectoparasite species in sheep based on sex, age and body condition scores, number in case and (prevalence in %).

Species of ectoparasites	Sex			Age			Body condition score			
	Male (n=146)	Female (n=247)	χ^2(P-value)	Young (n=134)	Adult (n= 259)	χ^2 (P-value)	Good (n= 127)	Medium (n= 148)	Poor (n=118)	χ^2 (P-value)
A. variegatum	5(3.4%)	15(6.1%)	1.332(.343)	10(7.5%)	10 (3.9%)	2.372(.147)	4(3.1%)	3(2.0%)	13(11.0%)	12.447(.002)
B. decoloratus	4(2.7%)	4(1.6%)	0.578(.476)	1(0.7 %)	7 (2.7%)	1.695(.274)	2(1.6%)	3(2.0%)	3(2.5%)	0.287(.866)
R. pravus	2(1.4%)	14(5.7%)	4.341(.038)	3(2.2%)	13 (5.0 %)	1.748(.282)	1(0.8%)	3(2.0%)	12(10.2%)	16.326(.000)
R. praetextatus	6(4.1%)	19(7.7%)	1.977(.201)	5(3.7%)	20 (7.7%)	2.361(.189)	4(3.1%)	2(1.4%)	19(16.1%)	27.230(.000)
R. pulchellus	5(3.4%)	11(4.5%)	0.249(.793)	3(2.2 %)	13 (5.0%)	1.748(.282)	3(2.4%)	1(0.7%)	12(10.2%)	16.555(.000)
R.evertsievertsi	4(2.7%)	14(5.7%)	1.800(.218)	4(3.0 %)	14 (5.4%)	1.184(.321)	6(4.7%)	3(2.0%)	9(7.6%)	4.720(0.094)
R. sanguineus	3(2.1%)	12(4.9%)	1.965(.185)	9(6.7%)	6 (2.3 %)	4.657(.048)	1(0.8%)	1(0.7%)	13(11.0%)	23.816(.000)
H. truncatum	3(2.1%)	5(2.0%)	0.000(1.00)	0(0.0 %)	8 (3.1%)	4.225(.055)	1(0.8%)	4(2.7%)	3(2.5%)	1.474(.478)
D.ovis	2(1.4%)	3(1.2%)	0.18(1.000)	1(0.7%)	4 (1.5 %)	.448(.665)	0(0.0%)	1(0.7%)	4(3.4%)	6.268(0.44)
H. impeltatum	0(0.0%)	1(0.4%)	0.593(1.00)	0(0.0 %)	1 (0.4 %)	.519 (1.00)	0(0.0%)	1(0.7%)	0(0.0%)	1.660(.436)
B. ovis	36(24.7%	48(19.4%)	1.49(.252)	26(19.4%)	58 (22.4 %)	.470(.519)	26(20.5%)	25(16.9%	33(28.0%)	4.882(.087)
Ctenocephalides species	8(5.5%)	18(7.3%)	0.486(.536)	21(15.7%)	5(1.9 %)	26.990(.00)	6(4.7%)	10(6.8%)	10(8.5%)	1.400(.497)
H.anatolicum. anatolicum	3(2.1%)	3(1.2%)	0.431(.675)	0(0.0 %)	6(2.3 %)	3.152(.099)	0(0.0%)	3(2.0%)	3(2.5%)	3.025(.220)
Over all	58 (39.73%)	109 (44.13%)		56 (41.79%)	111 (42.86%)		35 (27.56%)	40 (27.03%)	92 (77.97%)	

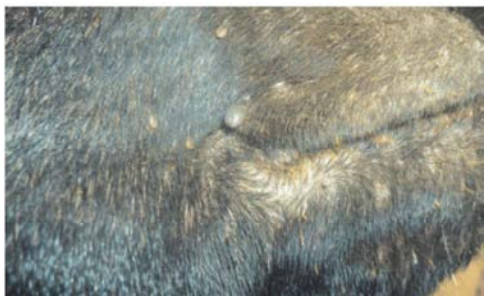

Fig. 1a: *Ammboyomma Varigatum* infestation around oral region of the goat, from Harar

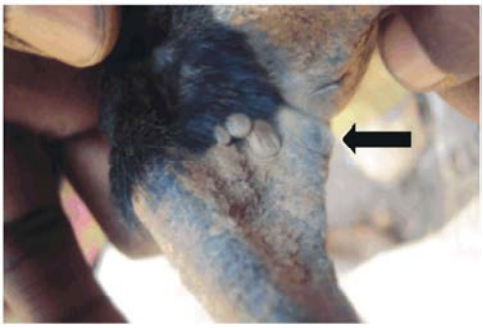

Fig. 1b: *Rhipicephalus evertsi* on the anal sphinicter of goat, from Dire Dawa

Fig. 1c: *Rhipicephalus decloratus* in the interdigital space of sheep leg, from Haramaya district

Fig. 1d: Abscessive lesion on the eye and eye lid due to severe infestation of *Rhipicephalus pravus*, from Erer district

Fig. 1e: *Rhipicephalus praetextatus* infestation in the interior surface of the goat ear, from Jijiga

Fig. 1f: Alopacia around the neck and ear area of the goat due to *Psoroptes cuniculi*, from Jijiga

Fig. 1g: Reddness and excoriative lesion due to *Rhipicephalus praetextatus* on the interior surface of the sheep ear, from Harar

DISCUSSION

The prevalence of ectoparasite in sheep and goats was 42.5% and 51.4%, respectively (Table 1). This finding was in line with the report of Bersissa *et al.* [16] who reported prevalence of 48.4 % in sheep and Kebede *et al*. [17] 49.7 % in goats. The tick infestation was 30.7 % in the present study less than the report of Fufa *et al*. [18] who reported tick prevalence of 76.50 %. The present study indicate significantly ($P<0.05$) higher prevalence of tick in

goats than in sheep (Table 1). This is in consent with the report of Sisay *et al*. [19] with respective prevalence of 17.7 % and 3.9 %in goats and sheep. This is probably due to the absence of wool and thick hair coverage on the body of the goats which make the attachment of the tick much easier on the body of the goats. Unlike, the sheep, goat body is more open and exposed to tick attachment, especially for ticks like *Rhipicephalus evertsi evertsi* which prefer the hind part of the body, specifically the anal area (Fig. 1b).

According to the present study some ticks were significantly (P<0.05%) more prevalent in adult animals than the young one (Table 3, 4); similarly, Tewodros *et al*. [20] report shows the same trend. Body condition wise, most tick species have significantly (P<0.05%) higher prevalence in poor body condition animals, which was also the case in the work of Kebede *et al.*[17]. Among the ticks, *Rhipicephalus* genus has higher prevalence than the other tick genus like the *Ambloyoma* species (Table 3). This result is in line with the work of Dawit *et al.* [21]. However, report of Mersha *et al*. [22], contradict this result by claiming that *Ambloyoma varigatum* was the upper most tick species among the tick finding in central and western Ethiopia. This variation was probably due to the agro ecological difference specifically, the present study areas is mid and low land with less grazing land and more of thorny bush areas. On the contrary, ticks like *Ambloyoma varigatum* is known to be prevalent more in the highland districts where there is grazing pastures and less woodland and thorny bush areas Taylor *et al*. [15].

The overall prevalence of lice in the present study was 13.5 % (Table 2). *Linognathus* species were predominant (p<0.05) in goats with poor body condition (Table 3). Similarly, Sisay *et al.* [19], state that the prevalence of *Linognathus* species was 3.5 times higher in goats with poor body condition than in good body condition goats. The prevalence of *Bovicola ovis* in sheep was higher than the *Linognathus africanus* of goats. This is due to *Bovicola* lice are much more active and mobile than *Linognathus* lice, roaming in the wool over the whole body of the sheep. The prevalence of *Bovicola* species solely in sheep in the present study is explained by the habit of *Bovicola* species preferring much fleece than *Linognathus* which is provided by the sheep Taylor *et al.* [15].

The study presents, flea's prevalence of 8.8 % (Table 1). Flea infestation in the goats (10.6%) was significantly (P<0.05) higher than in the sheep (6.6%). Likewise, report by Jemere *et al.* [23] fully complied, with the present finding in that significantly (p<0.05) a higher prevalence of fleas in goat (32.31%) was encountered than in the sheep (6.83%). In the present study the prevalence of fleas in young animals was significantly (p<0.05) higher than the adult animal (Table 3, 4). This result is also shared by Dawit *et al.* [21]; Yacob *et al*. [24]. The higher prevalence of fleas in the younger animals is probably associated to the thin skin and short hair of young animals in which the flea can access and penetrate the skin easily Dawit *et al.* [21].

The overall prevalence of the mite was 2.7 % (Table 1) and it is lower than previous reports by Assegid [25]; Tesfaheywet and Misgana [1] with mite prevalence of 7.4 % and 5.2%, respectively. The present study indicate that mite infestation in goats was significantly (p<0.05) higher than in sheep. This result is in agreement with the work of Enquebaher and Etsay [12]; Desie *et al.* [26] in Northern and Southern parts of the country. In fact, Enquebaher and Etsay [12] claim that goats were at 9.17 times at higher risk of acquiring mite than the sheep. Finding of the present study shows mites prevalence were significantly higher in animal with poor body condition (Table 3, 4). This result is in agreement with previous studies by Tesfaheywet and Misgana [1]; Yifat *et al.* [27]. This might be due to nutritional status, where well-fed animals can better withstand parasites infestation than animals on an inadequate diet which can influence level of immunity. Alternatively, mange might be a cause for poor body condition; hence high prevalence was computed in this group of animal [28].

CONCLUSION

In conclusion, a wide range of ectoparasite fauna were encountered during the study, implying that ectoparasites are important challenges of animal production across the study areas. Consequently, preventive measures should be put in place including scheduled preventive and control schemes with reference to the seasonal prevalence of ectoparasites.

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