Mange mites of sheep and goats in selected sites of Eastern Amhara region, Ethiopia

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Abstract A cross sectional study of small ruminant mange mites was conducted from November 2011 to April 2012 on a total of 324 sheep and 680 goats, to determine the prevalence of mange mites in sheep and goats, identifying the major species of mite and to determine the potential risk factors significantly predicting the disease. The result showed an overall mange mite prevalence of 7.5 % (95 % CI 5.5–9.5) in goats and 1.2 % (95 % CI 0.5–1.9) in sheep. The mites identified were *Sarcoptes* and *Demodex* in goats and *Sarcoptes* and *Psoroptes* in sheep. The prevalence of mange mites was significantly higher in goats than in sheep ($\chi^2 = 16.636$, $P = 0.000$). There was higher prevalence of mange mites in poor body condition than good body condition sheep and goats and the difference was statistically significant ($\chi^2 = 5.513$, $P = 0.019$ in sheep and $\chi^2 = 141.85$, $P = 0.000$ in goats). But age and sex of the host animals and agro climates were not statistically significant predictors of prevalence of mange mite. This study demonstrated that mange mites are among the major parasitic health problems of shoats in Eastern Amhara region that require urgent control intervention..

Keywords Eastern Amhara · Mange mites · Prevalence · Risk factor · Sheep and goat

Introduction

Live stock production is an important sector of Ethiopia's agricultural economy, providing a significant contribution to gross domestic and export products and raw materials for industries. Small ruminants are important contributors to the economy of the country; providing 25 % of meat consumption, about half of the domestic wool requirements and 92 % of the value of semi-processed skin and hide export trade (Adane and Girma 2008).

Though Ethiopia has very good potential to produce substantial quantities of skins, the quality of skins supplied is deteriorating from time to time. This has resulted in ever increasing complaints about the quality of skins available to local tanners and the export market (Tekle 2009). This was mostly due to the effect of ectoparasites including mange mites which cause serious skin defects that end up with down grading of quality and rejection of skin (Kassa 2005; Tefera and Abebe 2007a, b).

Mange mites together with other ectoparasites was a serious problem for small ruminant production and the tanning industry in Amhara regional state of Ethiopia and needs control measure (Demissie et al. 2000; Tefera and Abebe 2007b). Considering its effect a regional small ruminant ectoparasites control program was set (MoARD 2005) and practiced in the region starting from 2007 (KLeeman 2008). After the commencement of the control program there is no detail information on the status of mange mites in the Easter part of the Amhara regional state. Therefore, this study was conducted to estimate the prevalence of mange mites on small ruminants in selected sites of Easter Amhara region and to determine the possible risk factors associated with the occurrence of mite infestation.

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Materials and methods

Study area

The study was carried out in selected districts of Amhara national regional state which are found to the north east of Ethiopia, namely Bati (Oromia zone) and Kombolcha (South wollo zone) from November 2011 to March 2012. Ectoparasites control program is ongoing in these areas since 2007. The districts represented different agro climates viz. lowland (Bati) and mid land (Kombolcha). They are located at 417 and 375 km North of Addis Ababa with maximum temperature of 23.9 and 33 °C, respectively. There is long heavy rainy season from June to September and short rainy season from March to may in both districts.

Study population

To determine the prevalence and associated risk factors, the study population includes all indigenous sheep and goats in the two study districts kept under extensive management system.

Study design

The study design was a cross-sectional epidemiological study on mange mite of small ruminants. The prevalence of mange mites, association of host and agro-climate (environment) related risk factors (explanatory variables) with the presence of mite infestation (response variables) were investigated. The host risk factors considered was age, body condition, and species while midland and lowland were environment related risk factors.

Sample size and sampling method

The sample size for this study was determined using the formula described by Thrusfield (2005). Based on this formula and taking expected prevalence of mange mites 11.8 % for sheep (Demissie et al. 2000) and 33.27 % for goats (Abdulahmid 2001), and 95 % confidence interval with a 5 % absolute precision the sample size required were 162 sheep and 340 goats in each district.

The two districts were selected purposively to represent the different agro-climatic zones (lowland and midland) and from each district three Peasant Associations (PA) were selected by simple random sampling technique. Sheep and goats from each PA were sampled using systematic random sampling technique from animals that were presented for vaccination against some diseases such as Sheep pox, Pasturellosis and Anthrax.

Sample collection, examination and identification of mange mite species

At the time of clinical examination of each sampled animal age, sex and body conditions were recorded. Body condition score of the animal was made as poor and good; by modifying the system described in Gateby (1991) for sheep and Steele (1996) for goats. Poor body condition score was given to sheep and goats which were extremely thin to those with smooth and less prominent spinous process, transverse process in which finger can be pushed and moderate depth loin muscle. Good body condition score was given for sheep and goats in which the spinous process only stick up very slightly; smooth, rounded and well covered transverse processes and those having full loin muscle and very fat. Age categorization into young (lamb/kid) and adult was performed as described by Gateby (1991) for sheep and Steele (1996) for goats. Accordingly those sheep and goats under 1 year were categorized as young and the rest as adult.

Each sampled small ruminant were clinically examined for the presences of skin lesions like scales, crust, alopecia and clinical signs of itching. Skin scrapings from mange like lesions from clinically suspected animals were collected in a clean universal bottle, for detailed laboratory examination. Multiple skin scrapings from the edges of visible active mange like lesions for mites were collected, preserved in 70 % alcohol. The samples were processed in the laboratory by direct smear and sedimentation methods and examined under microscope using low power of magnification (Chauhan and Agarwal 2006).

The samples collected were processed in Kombolcha Regional Veterinary Laboratory, Parasitology department. In the laboratory skin scrapings were digested by adding few drops of 10 % potassium hydroxide and gentle heat to hasten digestion and to free the mites. After 30 min, a drop of the sediment was examined for the presences of mites on a slide with cover slip under the lower power of the microscope. Mite identification was performed according to Wall and Shearer (2001).

Data analysis

The data collected was entered into Microsoft Excel spread sheets and analyzed using SPSS (17.0) statistical software. The association of mange mite infestation between species of animals, agro climate, body condition, sex, and age of sheep and goats were compared using Chi square test (χ^2) and P-value < 0.05 considered significant.

Results

Prevalence and analysis of risk factors

In this study the overall prevalence of mange mites was 7.5 % in goats and 1.2 % in sheep. The types of mites indentified in goats were *Sarcoptes scabies* var *caprea* (6.9 %) and *Demodex caprea* (0.6 %) and in sheep *Pso- roptes ovis* (0.9 %) and *Sarcoptes scabiei* var *ovis* (0.3 %) (Table 1). Mange mite lesions were detected at the highest frequency from the ear, head and neck region with prevalence of 66.6 % (34 of 51) followed by generalized infestation 33.3 % (16 of 51), back side 31.3 % (9 of 51), the region of flank 7.8 % (4 of 51) and tail 1.96 % (1 of 51) on goats. In sheep the distribution of mange mite lesion was 25 % (1 of 4) on the ear and 75 % (3 of 4) on the region of the flank.

The data was analyzed to see the association of the risk factor with the prevalence of mite infestation both in sheep and goats. The risk factors considered were species of animals, body condition, age, sex and agro climate. The prevalence of mange mites in goats (7.5 %) was significantly higher than the prevalence in sheep (1.2 %) ($\chi^2 = 16.363$ and $P = 0.000$).

In goats, from the factors considered body condition of the animal was found to be risk factor for infection with mites. The prevalence of mange mites in poor body condition goats were statistically significantly higher than those in good body condition goats ($\chi^2 = 141.85$ and $P = 0.00$). Other factors considered for analysis have no statistically significant association with the infection of goats by mites (Table 2).

From the factors consider as a risk factor for mange mite in sheep it was only body condition of sheep which was statistically significantly associated. The prevalence of mange mite in sheep with poor and good body condition was 5.1 and 0.7 %, respectively, and this prevalence

difference was statistically significant ($\chi^2 = 5.513$, $P = 0.019$). Other factors considered (age, sex and agro climate) were not significantly associated with the disease (Tables 3, 4).

Discussion

In the current study the overall prevalence of mange mite observed in goats was similar to that was reported in Wolaita by Desie et al. (2010) and Enquebahe and Etsay (2010). However, it was lower than that was reported by Demissie et al. (2000) 59.6 % from Amhara regional state. The low prevalence of mange mites infection of goats in our current report might be due the implemented control program. The prevalence in sheep was similar to that of Enquebahe and Etsay (2010) who reported 0.95 % prevalence in Tigray region and Desie et al. (2010) who reported 1.98 % from Wolaita but it was very lower than the report of Demissie et al. (2000) 11.8 % from Amhara regional state.

According to this study, there was significant difference in the susceptibility of mange mite infestations among the two species of animals. Goats were more susceptible than sheep. This was in agreement with reports by Yacob et al. (2008) who underlined the susceptibility of adult goats compared to adult sheep. The observed variation was due to an increased prevalence of Sarcoptic mange in goats than in sheep. This agrees with the fact that infestation by Sarcoptic mange mites is rare conditions in sheep (Wall and Shearer 2001). The prevalence of sarcoptic mange mite in this study both in sheep and goats was in agreement with the work of Tefera and Abebe (2007a) who reported prevalence of 0.4 and 6.9 % for sheep and goats, respectively. In contrast this result was lower than the works of Tadesse et al. (2011) and Abdulahmid (2001) both from Combolcha who reported sarcoptic mange prevalences of

Table 1 The prevalence of ectoparasites identified on sheep and goats

Ectoparasites	Sheep (n=738)			Goat (n=492)		
	Total positive	Prevalence	95 % CI	Total positive	Prevalence	95 % CI
<i>D. ovis</i>	228	30.9	26.0–34.2	0	0	0
<i>D. caprae</i>	0	0	0	4	0.8	nd
<i>M. ovinus</i>	80	10.8	8.6–13.0	0	0	0
<i>Linognathus</i> species	23	3.1	1.9–4.4	133	27.0	25.0–29.0
Ticks	29	3.9	2.5–5.3	87	17.7	14.3–21.1
Demodex	0	0	0	11	2.2	0.9–3.5
Flea	8	1.1	0.4–1.9	13	2.6	1.2–4.0
Mixed infestations	37	5.0	3.4–6.6	34	6.9	4.7–9.1
Overall	331	44.9	41.3–48.5	214	43.5	39.1–47.9

nd not determined

Table 2 Logistic regression analysis result for association of potential risk factors with the prevalence of ectoparasites in sheep

Major ectoparasites	Risk factors	Risk factor category	Prevalence (%)	P-value	OR	95% CI for OR
<i>D. ovis</i>	Agro-climate	Highland (n = 246)	19.5			
		Lowland (n = 246)*	24.8	0.04	1.6	1.0–2.5
		Midland (n = 246)*	48.4	0.000	3.7	2.4–5.5
		Midland (n = 246)**	48.4	0.000	2.3	1.5–3.4
	BCS	Poor (n = 362)	40.1	0.000	1.9	1.4–2.8
		Good (n = 376)	22.1			
<i>Linognathus</i> species	Age	Young (n = 297)	36.7	0.119	1.3	0.9–1.8
		Adult (n = 441)	27.0			
	Agro-climate	Highland (n = 246)	1.2			
		Lowland (n = 246)	0.0	–	–	–
		Midland (n = 246)*	8.1	0.003	6.3	1.8–21.6
Ticks	BCS	Poor (n = 362)	5.2	0.03	3.5	1.1–10.6
		Good (n = 376)	1.1			
	Age	Young (n = 297)	3.0	0.297	0.6	0.3–1.5
		Adult (n = 441)	3.2			
Agroclimate	Highland (n = 246)		0.0	–	–	–
	Lowland (n = 246)		8.1			
Midland (n = 246)**	BCS	Poor (n = 362)	3.7	0.124	0.5	0.2–1.2
	Good (n = 376)		2.8	0.807	0.9	0.4–2.1
Age	Young (n = 297)		5.1			
	Adult (n = 441)		1.0			
Adult (n = 441)	Young (n = 297)		5.9	0.008	5.3	1.5–18.0
	Adult (n = 441)					

* Highland reference, ** Lowland reference

Table 3 Logistic regression analysis result for association of potential risk factors with the prevalence of ectoparasites in goats

Risk factors	Category of risk factors	Ectoparasites								
		<i>Linognathus</i>			Ticks			Flea		
		P (%)*	P-value	OR (95 % CI for OR)	P (%)*	P-value	OR (95 % CI for OR)	P (%)*	P-value	OR (95 % CI for OR)
Agro-climat	Midland (n = 246)	34.6	0.007	1.8 (1.2–2.8)	14.2			4.9	0.019	11.8 (1.5–93.0)
	Lowland (n = 246)	19.5			21.1	0.024	1.7 (1.1–2.8)	0.4		
BCS	Poor (n = 181)	44.2	0.000	3.5 (2.3–5.3)	19.9	0.15	1.4 (0.9–2.3)	3.9	0.528	1.4 (0.5–4.4)
	Good (n = 311)	17.0			16.4			1.9		
Age	Young (n = 242)	31.0	0.064	1.5 (0.9–2.3)	15.7	0.225	0.7 (0.5–1.2)	3.3	0.363	1.7 (0.5–5.3)
	Adult (n = 250)	23.3			19.6			2.0		

* Prevalence

Table 4 Prevalence of *M. ovinus* on highland sheep based on risk factors

Risk factors		prevalence (%)	P-value	OR	95 % CI for OR
Wool length	Short wool (n = 112)	14.3		1	
	Long wool (n = 134)	47.8	0.000	5.4	2.7–10.5
Age	Adult (n = 139)	19.4		1	
	young (n = 107)	49.5	0.000	4.1	2.1–7.5
BCS	Good (n = 123)	24.4		1	
	Poor (n = 123)	40.7	0.735	1.1	0.6–2.1

14.28 % in sheep and 33.27 % in goats, respectively. The result in general shows that the prevalence of mange mites is lower than the previous reports and this may be partially due to the existing ectoparasite control activity undertaking in the study area. The ongoing ectoparasites control program might have created awareness to animal owners to treat clinically sick animals.

In this study the prevalence of mange mite in sheep was the same (1.2 %) in both lowland and midland where as in goats 5.9 and 9.1 % in midland and lowland, respectively. The relative higher prevalence of mange mites in goat in the lowland area may be due to the higher contact of the animals during shading from high temperature stress and also the existence of higher goat population in the area (Pangui 1994).

According to Soulsby (1982) and Kusiluka and Kambage (1996) age of small ruminants is a predisposing factor for the occurrence of disease both in sheep and goats. In contrary to this in the present study age was not a predictor of prevalence of mange mite both in sheep and goats. Similar result was reported by Desie et al. (2010) in Walaita Sodo and Tefera and Abebe (2007a) in Eastern Amhara region.

In this study sex was not associated with prevalence of mange mites which was in line with the work of Desie et al. (2010) and Enquebaber and Etsay (2010). However the prevalence was slightly higher (8.1 %) in male than female (7.1 %) goats in this study. This may be due to frequent contact of male goats at the time of mating and fighting in that most male goat fight each other.

According to Radostits et al. (2007) and Soulsby (1982) well fed animals can better with stand parasite infestations than animals on an inadequate diet, which can influence the level of immunity. In agreement with this in the present study the prevalence of mange mites was significantly higher in poor condition animals than that was observed in good body condition animals. Similar result was reported by Tefera and Abebe (2007a) and Enquebaber and Etsay (2010).

In conclusion, even though the Amahara regional state of Ethiopia is implementing control strategy against ectoparasites of small ruminants in the last 3 years, contrary to this effort, the present study revealed the occurrence of mange mites in sheep and goat with the possible risk factors. Based on this observation, further coordination and strengthening of the existing ectoparasite control program in Amhara regional state is recommended. Furthermore the ongoing control program should be evaluated as of its impact on the level of reduction of other ectoparasites in the area.

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