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The Prevalence of Mange Infestations in Small Ruminants in Three Agro-Ecological Zones of Wolaita Zone, Southern Ethiopia

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Abstract
A cross-sectional study of small ruminant's mange mites was conducted in the three agro-ecological zones of Wolaita zone, Southern Ethiopia from November 2011-April 2012. The study aimed to determine the mange mite prevalence and to identify the main species infesting small ruminants. A total of 300 small ruminants (155 goats and 145 sheep) were examined for mange mite infestation, by using simple random sampling method. From these, 14 animals (9 goats with the prevalence of 5.8% and 5 sheep with the prevalence of 3.45%) were positive for mange mites with the overall prevalence of 4.67%. The species of mange mites identified in the current study were *Sarcoptes* (2.67%), *Demodex* (1.33%), and mixed (*Sarcoptes* and *Demodex)* 0.67%. The prevalence of *Sarcoptes* was higher in goats and in lowland than in sheep and midlands and highlands. However, the prevalence of mange mites across risk factors like agro-ecology, sex, species, age group, body conditions and body sites was not statistically significantly different ($p>0.05$).
Keywords: Agro-ecology, Goat, Mite, Prevalence, Sheep, Wolaita.

1. INTRODUCTION

One of the most important immediate goals for Ethiopia is to become self-sufficient in food production with estimated livestock population of 41,527,142 cattle, 41 millions of shoats, 11 million camels, 5,821,297 equines and 52 million chickens. The country has the largest livestock populations of the African continent (CSA, 2003). Out of these, 2.4 million sheep and 2.2 million goats are found in Southern Nation's Nationalities and People Regional State (SNNPRS) (Desta, 2007). Meanwhile small ruminants constitute about 30% of the total livestock population of the country and among important contributors to food production in Ethiopia, providing 35% of meat consumption and 14% of milk consumption (Asfaw, 1997). In central highlands where mixed crop-livestock production system is a usual practice, small ruminant accounts for 40% of cash income and 19% of the household meat consumption (Zelalem and Fletcher, 1999).

Owing their high fertility, short generation interval and adaptation even in harsh environments sheep and goats are considered as investments and insurance to provide income to purchases food during a period of crop failure and to meet seasonal purchases such as fertilizer and medicines for rural households (Asfaw, 1997; ESGPIP, 2009). The huge small ruminant sources serve as important source of income for agricultural community and are one of the Ethiopia's major sources of foreign currency through exportation of live animals, meat, wool and skin (Desta *et al*., 2007).

Importance of hides and skin accounts 12-16% of the total value of export items of Ethiopia. However hides and skins are important source of income, its contribution to national economy may be far below the expected potential due to the effect of ectoparasites infestation (Bayou, 1998). The current utilization of hides and skins is estimated to be 48% for cattle hide and 75% of goat skin (Stoic, 1997).

Currently different causes of skin diseases of small ruminants in Ethiopia are accountable for considerable economic losses particularly to the skin and hide export due to various defects (ESGPIP, 2009). Skin diseases caused by lice, sheep ked (*Melophagus ovine*), ticks and mange mites are among the major diseases of the small ruminants and cause serious economic loss to the farmers through mortality, decreased production and reproduction, down grading of hide and skins, and rejection of skins which also affect the tanning industries. According to tanneries report, skin diseases due to external parasites cause 35% sheep skin and 56% goat skin rejection (Bayou, 1998).

Mange is a collective name for allergic dermatitis caused by ectoparasites infestations by mites that are obligate parasites and spread from ranching that leads to inflammation, exudation and scabs formation on skin (OIE, 2008).

Transmission occurs by a direct contamination and contaminated fomites can be source of infestation. Poor nutrition and concurrent infections increase the susceptibility of animals to mange mites. Mange mites are very contagious, can spread rapidly and can have severe economic consequences on animal health. The host reaction to mites results in intense itching accomplished by hair loss, which can predispose the host to secondary bacterial infections (Soulsby, 1998). According to Urquhart *et al.,* (1996) mites can be grouped into parasitic and free living forms, and few of free livings act as both occasional parasites and as intermediate hosts (IH) of anoplocephalid cestodes including Anoplocephala, Moniezia and Stilesia. A recent report showed that mange in sheep and goat killed about 60% of the affected animals in Amhara region (Amsalu *et al*., 2000). In Ethiopia, 35%of sheep`s and 56% of goat`s skin are rejected annually due to various factors (Desta *et al*., 2007), of which mite infestation accounts for 33% in sheep and 21% in goats.

Although mange mites in small ruminants are prevalent and there is increasing severity and periodic rapid spread of the disease in the SNNPRS and mostly on the Wolaita zone, the distribution density, the current prevalence rate and the main species infesting the small ruminants were not well identified as the severity of the disease

Thus, the study on the occurrence and prevalence of mite infestation is valuable. Therefore, this study is initiated with the following objectives.

- To determine the current prevalence of mange infestation in small ruminants in three agro ecology of Wolaita zone, SNNPRS.
- To identify the major species of mange mites infesting small ruminants in the study area.

3. MATERIALS AND METHODS

3.1. Study area

The study was conducted in the three agro ecological zones namely Humbo (lowlands), Offa (midland) and Sodo Zurea (high land) of wolaita zone. Wolaita zone has a total area of 4471.3km^2 and situated between 6-4^0-7.2^{0}N and 37.4^0-38.2^{0}E (WZFEDD, 2003).

Sodo town, the capital of Wolaita zone is located at a distance of 385 km South West from Addis Ababa. The zone has a several districts with a total land area of 43,837 hec. The climatic conditions of the zone are: 9% highland, 56% midland and 35% lowland. The altitude of the area ranges from 1200-2900 m.a.s.l. The climate of the study area has a mean temperature of 19^{0}c and a mean annual rainfall (RF) of 1370.6mm, which is bimodal type with long rainy period (from June to September) and short rainy period (from March to April) (WZFEDD, 2003). The area has 51.7% cultivated land, 6.4% cultivable land, 11.9% grazing land and 30% others (CSA, 2003).

The occupation of rural population is mixed farming practice where by crop and livestock are managed hand together. The livestock population is 692,222 cattle, 112,939 sheep (ovine), 81,939 goats (caprine), 3303 horse, 30,621 donkeys, 1153 miles and 378,427 poultry (CSA, 2001).

3.2 Study population and animals

The study populations were selected from backyard production that were traditionally managed and skin scrap samples were taken from a total of 300 small ruminant local breeds. The three districts were selected by considering the agro-ecology as Sodo Zuria (highland), Offa district (midland) and Humbo district (lowland). Form these three districts, six peasant associations were selected purposively by considering their settlements, road accessibility and transport, and availability and accessibility of the study population. District wise distributions of the number of studied animals were: Humbo 99 small ruminants (73 goats and 26 sheep), Offa district 102 small ruminants (62 goats and 40 sheep) and Sodo Zuria 99 small ruminants (79 sheep and 20 goats). Therefore, a total of 145 sheep and 155 goats (186 females and 114 males) were selected and samples were also taken and examined for the presence or absence of mange mites.

The study animals were sampled by simple random sampling method to assess the prevalence and to identify the main species of mange mites infesting the sheep and goats in the study area. The skin scraping was collected form animals with different body conditions, ages, body sites, from both sexes of the small ruminants and taken for examination.

3.3 Study design

A cross sectional study design was conducted to determine the prevalence and to identify the main species of mange mites infesting sheep and goats. The study was conducted from November 2011 to April 2012. These times are hot and dry seasons of the study area. During the study period the skin scrapings were collected from both suspected cases of mange mites and apparently healthy sheep and goats.

3.4 Sample size determination and sampling methods

The total number of small ruminants required for this study was calculated by simple random sampling method based on the formula given by Thrusfield, (1995). In this study, sample size was calculated by taking the previous prevalence of 20% (Asnake, 2010) as follows by the confidence level of 95%.

$$N = \frac{za^2 \, p\,exp\,(1-p\,exp)}{d^2}$$

Where, n=sample size

P exp=expected prevalence

Z*a*=related to confidence level (value of *a* level of significance)

D=desired level of precision (5%).

According to Thrusfield, (1995), a maximum number of 246 small ruminants were required. However, maximum effort was used to increase sample size for accuracy.

3.5 Study methodology

The examination of each animal was conducted by visual inspection and palpation of skin lesions for identification of mange mite species infesting small ruminants.

3.5.1 Sample collection

Skin scrapings from suspected cases of mange mites and from those of apparently healthy small ruminants was collected and taken directly to the Sodo Regional Veterinary Laboratory Clinical Parasitology laboratory for examination. If delay occurs in the examination, samples were preserved in 10% alcohol. Multiple sites were scrapped to increase the likelihood of mange mites' detection. Both superficial and a deep skin scrapings were made to diagnose both burrowing and non-burrowing mites (Yacob *et al*., 2008).

3.5.2 Clinical examination

Prior to clinical examination, the origin, age, sex, body site, breed, agro-ecology and body conditions were recorded in the data record book. The clinical examination was performed by visual inspection and examination of lesions on all parts of animals' body.

3.5.3 Sample examination

Samples were maintained at room temperature and examined for the presence of mange mites within 24 hrs.of collection. The collected samples were examined by microscope and further identification of species was conducted in the parasitology laboratory according to the methods for the identification described by Alterio *et al.*, (2004).

3.6 Data entry and analysis

The raw data collected from the study population were recorded in the data collection format prepared for this purpose and were managed by microscopic Excel data system. Data summarization and analysis was performed by using OpenEpi version 2.3. And consideration of the risk factors was done to observe the variation in mange mites' prevalence between sex, age, agro-ecology, body conditions, body sites and the mange mites' species by using x^2-test and p-value. The prevalence of mange mites was expressed as percentage by dividing the total number of small ruminants that were positive to mange mites to the total number of small ruminants examined. The prevalence of mange mites was calculated for different risk factors as the number of mange mites positive small ruminants examined divided by the total number of small ruminants investigated at particular time. The significant different between the prevalence of mange mites and the investigated risk factors was determined by using the descriptive statistics chi-square tests (x^2-values) and the p-values. A statistically significant difference or association between the variables (risk factors and the mite's prevalence) was considered to exist if the computed p-value is less than 0.05.

4. RESULTS

A total of 300 small ruminants (155 goats and 145 sheep) were examined for mange mites' infestation. The overall prevalence of mange mites' infestation was 4.67%. An identification of *Sarcoptes, Demodex*, and mixed infection (*Sarcoptes* and *Demodex*) was made (Table 1. From the total animals examined, 9 (5.8%) of caprine (goats) and 5(3.45%) ovine (sheep) were found to be affected by mange mites. This study also revealed that total 2.94% of young and 5.56% of adult animals were positive for mange mites. The prevalence rate of 4.39% in male and 4.84% in females of small ruminants was recorded in the current study. The degree of severity of mange mites' infestation was compared in three agro -ecological zones in the study area (Table2). This study showed that there was no statistically significant difference (P>0.05) in mange mites prevalence between ages, sexes, agro-ecology, body conditions, body sites and the species of small ruminants.

Table 1: The prevalence of mange mites identified in the study area

Mange mites species	Nº. of caprine examined	Nº. of ovine examined	Total animals examined	Total Nº. of positive animals	Total Nº. of negative animals	Prevalence (%)
Sarcoptes	155	145	300	8	286	2.67
Demodex	155	145	300	4	286	1.33
Mixed	155	145	300	2	286	0.67
Total	155	145	300	14	286	4.67

The degree of severity of mange mites' infestation was compared in three agro -ecological zones in the study area. The prevalence of 2.02%, 3.92%, and 8.08% was recorded in high land (Sodo Zurea), in midland (Offa district) and in lowland (Humbo district), respectively. However, there was no statistically significant difference between the agro-ecological zones (p>0.05) in relation to the degree of mite infestation (table 2).

Table 2: the prevalence of mange mite infestation in relation to agro-ecology, sex, species of animals and age groups

Factors		Nº. of animals examined	Nº. of positive animals	Nº. of negative animals	Prevalence (%)	X^2	P –value
Agro-ecology	Highland	99	2	97	2.02		
	Midland	102	4	98	3.92	4.28	0.1177
	Lowland	99	8	91	8.08		
	Total	300	14	286	4.67		
Sex	Male	114	5	109	4.39		
	Female	186	9	177	4.84	0.032	0.8568
	Total	300	14	286	4.67		
Species of animals	Caprine	155	9	146	5.8		
	Ovine	145	5	140	3.45	0.9364	0.3332
	Total	300	14	286	4.67		
Age group	Young	102	3	99	2.94		
	Adult	198	11	187	5.56	1.034	0.311
	Total	300	14	286	4.67		

The results indicated that there was no statistically significant difference ($p>0.05$) between sex of animals and the degree of mites infestation (table 2).

Species wise comparison was undertaken to observe the influence of species on the prevalence of mites' infestation. But there was no statistically significant difference ($P>0.05$) observed between ovine and caprine with regard to the prevalence of mites infestation (table 2). .

Age related comparison was considered to see the influence of ages on the occurrence and prevalence of mange mites' infestation on sheep and goats as tabulated in table 2 above. This study has revealed that there was no statistically significant difference ($P>0.05$) in prevalence of mites' infestation between the two age groups (young and adult).

Table 3: the prevalence of mange mite infestation in relation to body conditions and sites

Factors		Nº. of animals examined	Nº. of positive animals	Nº. of negative animals	Prevalence (%)	X^2	p-value
Body conditions	Thin	37	2	35	5.40		
	Poor	16	2	14	12.50		
	Moderate	144	8	136	5.56	4.62	0.3285
	Good	71	2	69	2.82		
	Total	300	14	286	4.67		
Body sites	Neck	68	6	62	8.82		
	Wither	26	1	25	3.85		
	Tail	76	6	70	7.90		
	Chest	15	1	14	6.67		
	Total	300	14	286	4.67	10.22	0.1762

Body condition related evaluation to observe the importance of body conditions on the occurrence and prevalence of mites' infestations on sheep and goats revealed that there was no statistically significant difference recorded in prevalence between the body conditions of the study animals as shown in table 3 above.

There was also an observation of body site related comparison to examine the influence of body sites` of animals on which the mites affect most prevalently and the prevalence of mites' infection on sheep and goat. The result indicated that there was no statistically significant association of different body sites ($P>0.05$) as mites infestation on sheep and goats is concerned in the current study area. In general, the recorded prevalence was 8.82 % on neck, 0.0% on whole back part, 3.85% on wither, 7.9% on tail, 6.67% on chest, 0.0% prevalence on flank, face and ear as shown on table 3.

5. DISCUSSION

The result of this study have revealed that an overall prevalence of 4.67% small ruminants mites' infestation. Of this total prevalence, 2.67%, 1.33% and 0.67% were recorded as *Sarcoptes*, D*emodex* and mixed (*Sarcoptes* and D*emodex*) infections, respectively. The current findings are similar with several other previous mange mites studies in different parts of the country: Desta *et al*. (2007) with the overall prevalence of 3.98% and species level prevalence of 2.61% S*arcoptes*, 1.23% *Demodex* and 0.14% mixed infection but the prevalence was 1.98% in sheep and 5.85% in goats in Southern Ethiopia, Yacob *et al.,* (2008) with the prevalence of 0.98% in sheep

and goats in southern Ethiopia, Chalachew (2001) 5.3% prevalence in sheep and 6.8% in goats in Southern Ethiopia, Gashaw (1986) with the prevalence of 7.85% in sheep and 11.8% in goats in Harrerghe. The annual animal disease report of Wolaita Sodo Regional Veterinary Laboratory /WSRVL/ also indicated the prevalence of 0.28% *sarcoptes* mange in sheep and 3.7 % *Demodectic* mange in goats in three selected districts (Asnake, 2006).

But the current study finding in the Wolaita zone is lower than the prevalence of mange mites reported in some parts of the country by Amsalu *et al., (*2000) in Amhara regional state with the prevalence of 87% in sheep and goats, by Molu (2000) in Southern range land of Oromia with the prevalence of 14.64% in sheep and 16.45% in goats, in Robie areas of Bale, 67.65% in sheep (Shenkutie, 1987) and Ashenafi (2003) with the prevalence of 30.2% in sheep and 31.8% in goats in Tigray region. Generally it is known that *Sarcoptes* occur more frequently on sparsely haired parts of the body (Kettle, 1995). Sherman (1998), also reported that the genus *Sarcoptes* was the most and highly prevalent mite in the study area.

The difference in prevalence of mange mites infestation in sheep and goats have been reported and observed in different parts of the country is mainly due to the variations in agro-climate conditions like altitude, humidity, management, temperature and rainfall. The management system can contribute to the variation in prevalence of mange mites' infestation and the existence of higher populations in small areas can facilitate the higher infestation rates as the main way of transmission is close contact between infected and apparently healthy animals (Taylor *et al*., 2007).

The findings of the current study disagrees with Desta *et al*. (2007), who reported that the agro-ecological zone contributed to the variation of mange mites infestation. The climatic conditions and the environment that may be suitable for the mites' occurrence like temperature, rainfall and humidity might be slightly similar in the three agro-ecological zones even if there was higher prevalence of the *Sarcoptes* recorded in the lowland (Humbo district (8.08%) (Wall and Shearer, 2001).

Comparison between the two sexes of animals and the mange mites infestation was conducted to observe the association of sex with mites infestation and there was no statistically significant difference (P>0.05) in prevalence between female (4.84%) and male (4.39%). This result showed that sex seems to have no effect on the prevalence and occurrence of mange mites and also indicates that both sexes of animals are equally susceptible to mange infestation when they both are exposed to mange mites. These results agree with the findings in Ethiopia by other researchers like Nigatu (2004), Amanuel (1994) and Desta *et al*. (2007).

Association of mites infestation with animal species exposed was examined and prevalence of 5.8% and 3.45% in caprine and ovine species, respectively, was observed. This study was not in line with Desta *et al*. (2007), Ashenafi (2003) and Gashaw (1986) who reported that there is higher prevalence of mange mites in goat than sheep. But there was no statistically significant difference (p>0.05) in prevalence between species of animals in this investigation.

This can be explained by the fact that their immunity is lower than the normal level or no prior exposure of the two species to prevent the disease occurrence and their resistant capacity may be the same for mange mite once exposed to the disease (Wall and Shearer, 1997).

When we compare different age groups (young and adult) to observe the influence of age on mite prevalence, there was no statistically significant difference (P>0.05) between the two age groups and mange mites prevalence. The results of the current investigation was in agreement with Desta *et al*. (2007), who stated that mange mites' infestation is independent of age and sex. This might be due to the occurrence frequent contact between the dams and the newborn during sucking and any motherhood action and most infestations are acquired with in early weeks of life (Tefera, 2004).

Mites' prevalence and infestation on small ruminants in relation to body conditions was carried out to observe the variation. The recorded prevalence in body conditions of animals were: 5.40%, 2.82%, 5.56%, 12.5% and 0.0% in thin, good, moderate, poor and fat, respectively. The study also showed that there was no statistically significant difference (P>0.05) in prevalence between the body condsitions of animals and the prevalence of mites infestation. The findings of the current study are not in agreement with Amsalu *et al*. (2000) and Molu (2002) who reported that the mites' infestation rate is higher in poor while lower in good body condition animals. This is might be attributed to the reasons that the diseases transmission route is mainly through contact. So, once there is contact of infested animals or object, they do have an equal chance of contracting the parasite regardless of their body condition. Probably, their body condition may help them for recovery if they are in good body condition (Wall and Shearer, 2001).

Mites' infestation and its prevalence on small ruminants were finally compared in this study in relation to different parts of the body sites. The prevalence of 8.82% on neck, 3.85% on wither, 7.9% on tail, 6.67% on chest and 0.0% on flank, face, whole back and ear. This study revealed that there was no statistically significant difference (p>0.005) in prevalence among the different body sites and mites infestation. This study results are contradicting with research finding of Kahn *et al*.(2005) and Ademe *et al*.(2006), who reported that the common sites of mange mites infestation were wither, neck, back and flanks. This might be due to the parasitic mites are

obligate parasites and once the exposure of the animals to the mite occur, then the mite can puncture any body parts of the host to feed the host cell contents, body fluids and sebaceous secretions without selecting the predilection sites of the body. Exposure to the stress factors like traumatic injury and wound on the skin may facilitate the mites' entrance and the disease occurrence (Taylor *et al.,* 2007).

6. CONCLUSION AND RECOMMENDATIONS

The study aimed to determine the mange mites' prevalence and to identify the main species of mites` infesting small ruminants in the three agro-ecological zones of Wolaita zone, Southern Ethiopia. The present study showed that there was a slight increase in prevalence of mange mites' occurrence on small ruminants in Wolaita zone (4.67%) and identified the two mite species as *Sarcoptes* and *Demodex.* From the present study it is possible to conclude that mange mite is prevalent in small ruminants in Wolaita zone of the country which underlines the need of effective control measures before the disease reaches to its peak level and result in great economic loss especial by limiting skin production and quality ultimately causing skin rejection. But as indicated by the findings of this research, the prevalence of mange mites across risk factors like agro-ecology, sex, species, age group, body conditions and body sites was no statistically significantly different.

On the base of the above conclusions; to produce high quality of skin and have sufficient food production, the following recommendations are forwarded:

- Strategic acaricide application and routine mange mite treatment practice should be implemented in the zone
- Awareness have to be created among all concerned bodies about favorable climatic conditions of seasons for mange mites and their effects on skin quality and animals' health and production.
- Further in-depth research should be initiated on mange mites of small ruminants especially to determine species involved in the disease process and to identify the risk factors that may facilitate the occurrence and prevalence of the disease.

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