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Original Article

Prevalence of Mange Mites among Goats in and around Haramaya District, Eastern Hararge, Ethiopia

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Abstract

Introduction: The current cross-sectional study, which was conducted between November 2018 and March 2019, aimed to identify common mange mite species and risk factors in goats.

Methods: Skin scraping from a universal bottle was macerated and examined under a microscope. If mites were not found, skin scraping was placed in a centrifuge tube with 10% KOH, mixed, and examined under the microscope to confirm parasite presence and diagnose mite species.

Results: In this study, skin scrapings from 422 participants were analyzed, and the prevalence of mange mites was 10.4%. Sarcoptes scabiei var. caprae (7.35%), Demodex caprae (2.1%), and mixed species (0.95%) were the most prevalent, respectively. The prevalence of the disease in Haramaya and surrounding areas was 12.9% and 9%, respectively, but there was no significant difference ($P > 0.05$) between the two research locations. The study found that female goats had higher infestation levels (13.7%) compared to male goats (3.1%), with a statistically significant difference ($P < 0.05$). Adult animals had a higher prevalence of mange (10.5%) compared to young animals (10.3%), but the difference was not statistically significant ($P > 0.05$). The higher level of infestation was observed in female goats (13.7%) compared to male goats (3.1%), and the difference was statistically significant ($P < 0.05$). The study found that mange prevalence in poor-body-condition goats was 26.4%, while in medium-body-condition goats it was 7.4%. Goats with a large herd size had the highest prevalence of mange infestation (47.7%), followed by medium (17.6%) and small (1.5%) sizes, with statistically significant variation ($P < 0.05$).

Conclusion: The study found that adult animals had a higher prevalence of mange (10.5%) compared to young animals (10.3%), but this difference was not statistically significant ($P > 0.05$). It was also found that the frequency of mange mites in extensive and semi-intensive management systems was 7.5% and 11.6%, respectively, with no statistically significant difference ($P > 0.05$). Mange mite cases require immediate action to lessen their economic impact because they are linked to poor management, low owner awareness, and a lack of animal health services.

Keywords: Demodex caprae, Goats, Mange mite, Prevalence, Sarcoptes scabiei var caprae

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Introduction

In Ethiopia, cattle account for around 40% of total agricultural output, making it a vital industry that contributes significantly to the country's gross domestic product (GDP) (1). Small ruminants, with their high fertility, short generation interval, and ability to adapt to harsh environments, are therefore significant contributors to Ethiopia's food supply, accounting for 35% of the country's meat consumption and 14% of its milk consumption (2).

Small ruminants help Ethiopia generate a significant amount of foreign currency through the export of skins and other byproducts, in addition to making a significant contribution to the income creation and food security of the majority of the country's smallholder farmers. The second largest export from Ethiopia is skins, both processed and semi-processed (3). A considerable portion of the pre-slaughter defects that account for 65% are directly related to skin diseases caused by the ectoparasite or to the secondary damage that occurs when the animal scratches itself to relieve the itching (4).

Defects resulting from external parasite damage, specifically cockle lesions, have skyrocketed in the last 10 to 15 years and are today Ethiopia's leading cause of skin downgrading and rejection (5). The external parasites that have so far been reported to be significantly affecting the tannery industry include mange (*demodectic* and *sarcoptic*), sheep ked, lice, and ticks (6). In Ethiopia, significant numbers of shoat skins are rejected annually due to various factors, of which mange infestation

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accounts for 33% in sheep and 21% in goats (7). Mange mites are common causes of clinical and subclinical skin diseases among small ruminants in many regional states and different agro ecologies in Ethiopia (3,8,9).

The growth retardation, decreased daily weight gain, labor and treatment costs, skin damage, and mortality rates associated with mite infestations have an economic impact on the affected animals (10). In addition, mites severely reduce the well-being of animals, reducing milk yield and hampering the milking process due to the restlessness of affected animals. Moreover, some mite species have zoonotic and public health implications (11). Despite research indicating that the Oromia region has different places where mange mite frequency is higher than others, nothing is known about the mange mite prevalence or related risk factors among goats in East Hararghe. Consequently, the following objectives guided the research process:

- Determining the prevalence of mange mites among goats in the study area.
- Identifying the mange mite species among goats in the study area.
- Determining the relationship between the prevalence of mange mites and some related factors.

Materials and Methods

Study Area and Period

The study was conducted in and around Haramaya district, Eastern Hararghe zone, Oromia Regional State, between November 2018 and March 2019. The study area was located 510 kilometers east of Addis Ababa. Its elevation is approximately 2000 masl, and the mean annual temperature and relative humidity are 18 °C and 65%, respectively. Annual rainfall is approximately 900 mm, with a bimodal distribution pattern peaking in mid-April and mid-August. There are four seasons: a short rainy season, a short dry season, a long wet season, and a long dry season. The main pasture production is expected after the short rainy season, continuing until the end of the long wet season. Mixed agriculture is the main occupation of the population of the area. The total livestock population of this district is 465 586: 118 966 cattle, 116 354 goats, 73 846 sheep, 33 278 donkeys, 10 mules, 631 camels, 145 432 poultry, and 7020 bee hives (12).

Study Population

The study animals were endogenous breeds of goats reared under extensive (n = 302) and semi-intensive (n = 120) farming systems in the study areas. Explanatory variables considered for the study were sex, body condition score, herd size as small (less than 10), medium (between 10 and 20), and large (greater than 20), age, and management system. The study animals were classified as young and adults according to the classification method used by (13). Body condition scores (good, medium, and poor) were recorded based on the criteria set by (14).

Study Design

A cross-sectional design was used to determine the prevalence and species of mange mites and assess the associated risk factors for their occurrence among goats.

Sampling Methods

Five kebeles in Haramaya districts were chosen based on accessibility, owner willingness, settlements, roads, and transport and were randomly sampled at the household level.

Sample Size Determination

The sample size was determined based on 50% expected prevalence, a confidence interval of 95%, and a desired level of precision of 5%. The total number of samples required for this study was calculated based on the following formula (15).

$$N = \frac{1.96^2 p_{exp}(1 - p_{exp})}{d^2}$$

In this formula, N is the required sample size, p is the expected prevalence, and d is the desired level of precision. Accordingly, the minimum sample size required for this study was 384. However, to increase our precision, a total of 422 goats were sampled.

Study Methodology

Sample Collection

A goat examination was conducted to identify mange mites infesting goats. The goats were categorized into apparently healthy and clinically suspected cases. Mange mites were identified by the presence of skin lesions like hair loss, erythema, pruritus, and scales. Multiple sites were scrapped to increase the likelihood of detection. Surface and deep skin scraping were used to identify the mites. If nodular skin lesions were suspected, white creamy pus content was collected. The samples were preserved in 10% formalin and transported to the College of Veterinary Medicine, Haramaya University (Figures 1 and 2).

Skin Scraping Examinations

Skin scraping from a universal bottle was macerated and examined under a microscope. If mites were not found, skin scraping was placed in a centrifuge tube with 10% KOH, mixed, and examined under the microscope to confirm parasite presence and diagnose mite species. (11,16).

Statistical Analysis

The study used Microsoft Excel and SPSS software to analyze data on mange mite prevalence. Chi-square was used to test the association between variables, and any p value less than 0.05 ($P < 0.05$) was considered statistically significant.

Results

Overall Prevalence of Goat Mange Mites

According to Table 1, the overall prevalence of goat mange mites in this study was found to be 10.4% (44/422). Of these, 7.35% (31/422) of the goats were infested by *sarcoptes*, 2.1% (9/422) were infested by *demodex* (Figure 3 and 4), and 0.95% (4/422) were infested by mixed species (*sarcoptes* and *demodex*).

Prevalence of Mange Mites between the Selected Sites

The prevalence of mange mites in the study area was found to be higher in Haramaya (12.9%) than around Haramaya (9%).However, statistical analysis of the data showed that there was no significant difference ($P>0.05$) in the prevalence of mange mites between the sites (see Table 2).

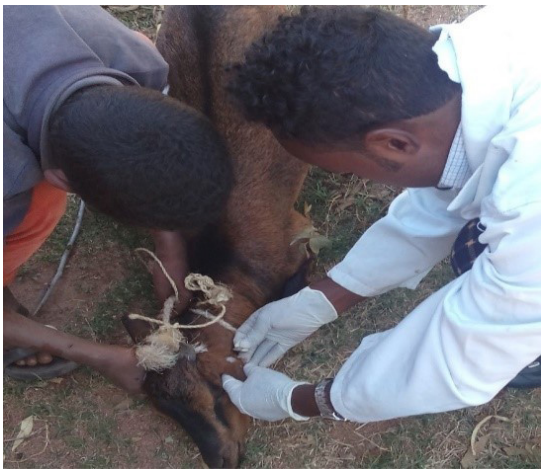

Figure 1. Picture During Animal for Sample Collection

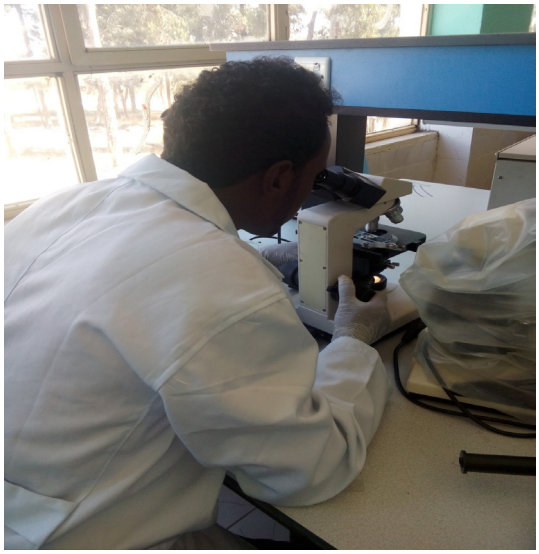

Figure 2. Picture During Sample Examination at Haramaya University Parasitology Laboratory

Table 1. Overall Prevalence of Mange Mite Species among Goats

Mange Mite Species	Positive	Prevalence (%)
Sarcoptes scabiei var *caprae*	31	7.35%
Demodex caprae	9	2.1%
Sarcoptes scabiei var *caprae* + *Demodex*	4	0.95%
Total	44	10.4%

Prevalence of Mange Mites Between Sexes

The prevalence of mange mites in our study was found to be higher in females (13.7%) than males (3.1%). This result was statistically significant ($P<0.05$) between sex groups (see Table 3).

Prevalence of Mange Mites Regarding Body Condition Score

The prevalence of mange mites in this study was found to be higher in poor body condition (26.4%) than medium body condition (7.4%); however, no mange mites were recovered from good body condition. The difference between the prevalences was statistically significant ($P<0.05$) among the body conditions of the animals (see Table 4).

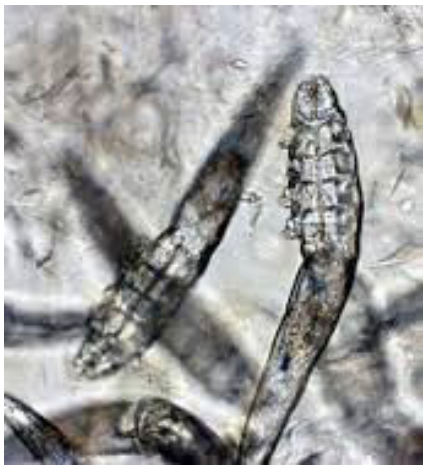

Figure 3. Demodex Picture Under a Light Microscope

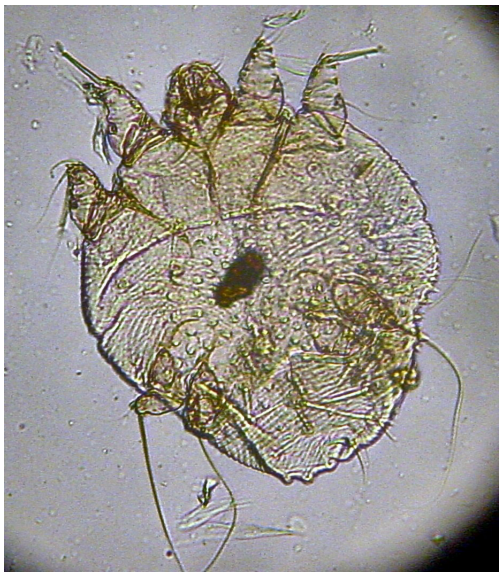

Figure 4. Sarcoptes Picture Under a Light Microscope

Table 2. Prevalence of Mange Mites in and around Haramaya

Selected sites	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
In Haramaya	155	20	12.9 %		
Around Haramaya	267	24	9 %	1.609	0.205
Total	422	44	10.4%		

Table 3. Prevalence of Mange Mites Between Sexes

Sex	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
Female	292	40	13.7%		
Male	130	4	3.1%	10.866	0.001
Total	422	44	10.4%		

Table 4. Prevalence of Mange Mites Regarding Body Condition Score

Body Condition score	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
Poor	87	23	26.4%		
Medium	285	21	7.4%		
Good	50	-	-	32.552	0.000
Total	422	44	10.4%		

Table 5. Prevalence of Mange Mites Among Herd Sizes

Herd Size	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
Small	270	4	1.5%		
Medium	108	19	17.6%		
Large	44	21	47.7%	94.619	0.000
Total	422	44	10.4%		

Table 6. Prevalence of Mange Mites Between Ages

Age	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
Young	194	20	10.3%		
Adult	228	24	10.5%	0.005	0.942
Total	422	44	10.4%		

Table 7. Prevalence of Mange Mites Between Management Systems

Management System	Sample Examined	Positive	Prevalence (%)	χ^2	*P* Value
Extensive	302	35	11.6%		
Semi-intensive	120	9	7.5%	1.538	0.215
Total	422	44	10.4%		

Prevalence of Mange Mites Among Herd Sizes

As Table 5 indicates, the highest prevalence was recorded concerning goats with a large herd size (greater than 20) (47.7%), followed by goats with a medium herd size (between 10 and 20) (17.6%), and goats with a small herd size (less than 10) (1.5%). The differences in the prevalence of mange mites among the herd sizes were statistically significant ($P < 0.05$).

Prevalence of Mange Mites Between Ages

Our study showed that out of the total 422 samples examined, 228 were from the adult age group (greater than or equal to 2 years), and the remaining 194 samples were from the young age group (less than 2 years), with a prevalence of 10.5% and 10.3% of mange mite infestation, respectively. However, statistical analysis of the data showed that there was no significant difference ($P > 0.05$) in the prevalence of mange mites between ages (see Table 6).

Prevalence of Mange Mites Between Management Systems

The study found that out of 302 goats under extensive management systems, 32 cases tested positive for mange mite infestation, with a prevalence of 11.6%, while out of 120 goats under semi-extensive management systems, 9 cases tested positive, with a prevalence of 7.5%. However, statistical analysis of the data showed that there was no significant difference ($P > 0.05$) in the prevalence of mange mites between management systems (see Table 7).

Discussion

The study revealed a 10.4% prevalence of goat mange mites in extensive and semi-intensive management systems, with 7.35%, 2.1%, and 0.95% being *Sarcoptes*, *Demodex*, and mixed infections, respectively. The result of this study lends support to the findings of previous studies conducted by Zeryehun and Tadesse (1) in Nekemte and Yasine et al (17) in northeastern Ethiopia, who reported 9.24% and 13.8%, respectively. Moreover, this result is in line with the findings of other previous studies conducted by (18), who reported a 10% overall and species-level prevalence of 3.65% *Sarcoptes*, 1.82% *Demodex*, and 0.52% mixed (*Sarcoptes* and *Demodex*) infection in Kindo Koysha district of Wolaita Zone, and Zeryehun and Mengesha (19), who reported 11.7% overall, 10.6% *Sarcoptes*, and 1.1% *Demodex* in and around Kombolcha.

Nevertheless, this result is relatively higher than that of the study conducted by Nuru and Mhatebu (20), who reported 5.94% in Haramaya woreda. This increase in mange infestation may be due to improper control of mange mites by animal health servants, a lack of owners' knowledge about the disease, decreasing grazing land, different flocks mixed together, and grazing in small areas, all of which contribute to the spread of the disease.

The prevalence recorded in this study is higher as compared to previous studies conducted in different parts of the country. For instance, Kindu et al (21) reported 3.26% in South Wollo Kutaber, Teka and Bekele (22) reported 3.57% in and around Jigjiga, and Pal et al (23) reported 4.76% in and around Jimma. This variation may be due to the level of infestation in the different areas in relation to environmental factors and management

practices applied.

However, this result is lower than what was found in other studies. For instance, Agegnehu et al (24) reported 24.6% in the Wag-Himra zone, Kumilachew et al (25) reported 29.4% in northeastern Ethiopia, and Molu (26, 27) reported 16.45% in the southern rangelands of Oromia. This variation in the prevalence of goat mange mites may be due to sample size, different management status, and the use of acaricides, attributed to differences in agro climate.

In the study area, a higher prevalence was observed in Haramaya (12.9%) and a lower prevalence around Haramaya (9%). This difference in prevalence might be associated with difference in flock population, which causes favorable conditions for the transmission of mites among animals and ultimately results in a high level of mite infestation (19). Another possibility in Haramaya is that many different flocks feed together and leave the leftover chaat that has been collected in one place. This can facilitate the higher infestation as the main way of transmission, which is caused by close contact between infected and apparently healthy animals (11,28).

This result was relatively higher in female goats (13.7%) compared to male goats (3.1%). The result was statistically significant ($P<0.05$, $P=0.001$, $\chi^2=10.866$). This is in agreement with previous studies conducted by Zeryehun and Mengesha (19) and Garedaghi et al (29), who recorded 9.1% and 2.6% in female and male animals, respectively, in and around Kombolcha, and Kumilachew et al (25) and Garedaghi et al (30), who recorded 31.1% and 25.5% in female and male animals, respectively, in northeastern Ethiopia. It might be associated with physiological stress conditions during pregnancy and lactation, the lesser emphasis given by owners on feeding female animals compared to the better feeding habits of owners in feeding male animals since they are used for mating, fattening, and higher financial gain at the market level for smallholder farmers. Contrary to this finding, other researchers reported a higher prevalence in male animals compared to female animals (24,31) in the Wag-Himra zone.

In this study, it was found that there was a statistically significant difference ($P<0.05$, $P=0.000$, $\chi^2=32.552$) with a higher prevalence of mange mites in poor-body-condition goats (26.4%) than medium-body-condition goats (7.4%). This is in line with the findings of previous studies conducted by Kumilachew et al (25), who reported a higher level of prevalence (48%) in poor-body-condition animals, while a lower prevalence (15.5%) was observed in medium-body-condition animals in northeastern Ethiopia. In addition, Nuru and Mhatebu (20) reported 60.53% in poor-body-condition animals, while 38.47% in medium-body-condition animals in Haramaya woreda. The difference might be due to an inadequate diet and other disease conditions causing poor body condition and influencing the level of immunity, which in turn results in an increase in the susceptibility of animals to mange mite infestations (27,33). This result is contradictory to the findings of (24,34), who reported a higher level of prevalence in animals with good body condition compared to animals with poor body condition in the Wag-Himra zone.

Our study showed that the highest prevalence was recorded concerning goats with a large herd size (greater than 20) (47.7%), followed by goats with a medium herd size (between 10 and 20) (17.6%), and goats with a small herd size (less than 10) (1.5%). The differences in the prevalence of mange mites among the herd sizes were statistically significant ($P<0.05$, $P=0.000$, $\chi^2=94.619$). One possible reason is that as herd size increases, so does competition for feeding, and at that time there is more contact among each other and stress when they are involved in fighting. This result is not in agreement with what was reported by Teka and Bekele (22) and Garedaghi & Khakpour (35) in Jigjiga. It might be due to a variation in environment and management system, and it might also raise awareness among owners as to the need for intervention to stop the spread of the disease.

This result revealed that the prevalence of mange mites was higher in adult goats (greater than or equal to 2 years) (10.5%) compared to young goats (less than 2 years) (10.3%). However, the result was not statistically significant ($P>0.05$, $P=0.942$, $\chi^2=0.005$). This might be related to the difference in grazing behavior, i.e., young animals may have poorer access to grazing or pasture than adults and increase the chance of being exposed to mange mites as age increases due to contact with infected goats when mating and also fighting each other with infected buck. This study lends support to the findings of Zeryehun and Mengesha (19) and Jannati et al (36), who reported 7.7% in adult animals and 4% in young animals in and around Kombolcha, and Teka and Bekele (22) and Shabestari et al (37), who reported a higher prevalence of mange mites in adult animals than young animals in Jigjiga. On the contrary, several studies (23,28,38) reported a higher prevalence of mange mites in young animals than the adult age group in Jimma and Janamora wereda, respectively. This might be due to the environmental differences in the study area.

The study found that extensive management systems had a higher prevalence of mange mite infestations (11.6%) compared to semi-intensive systems (7.5%), possibly due to close contact between goat flocks at communal sites.

Conclusion and Implications

The study found a slight increase in mange mite prevalence in goats, primarily due to sex, body condition, and herd size. Age and management systems did not contribute to the infestation. Poor management, owner awareness, and animal health extension services are believed to be

responsible for the high prevalence of mange mites. Based on the above conclusion, the following implications can be drawn:

- Farmers should prioritize proper feeding and care for female and emaciated goats.
- Infested animals should be treated with acaricides to reduce transmission.
- Preventing health mixing of flock unknowns is crucial.
- Extension programs should raise public awareness about the economic impact and seasonal dynamics of the disease.

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Authors' Contribution

Conceptualization: Hamza Mohammed Yuya, Abdallahi Abdurehman Damissie.
Data curation: Hamza Mohammed Yuya.
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Funding acquisition: Abdallahi Abdurehman Damissie.
Investigation: Hamza Mohammed Yuya.
Methodology: Lencho Ahmednur Mohammed.
Project administration: Abdallahi Abdurehman Damissie
Resources: Hamza Mohammed Yuya.
Software: Mohammedkemal Mustefa Ame, Hamza Mohammed Yuya.
Supervision: Abdallahi Abdurehman Damissie.
Validation: Mohammedkemal Mustefa Ame, Abdallahi Abdurehman Damissie.
Visualization: Mohammedkemal Mustefa Ame.
Writing–original draft: Hamza Mohammed Yuya.
Writing–review & editing: Mohammedkemal Mustefa Ame.

Competing Interests

In the study area, there is no conflict of interest in publishing this manuscript.

Ethical Approval

This study was approved by department of Veterinary Medicine, Chelenko Veterinary Clinic, Meta Woreda, Eastern Harerghe, Ethiopia for the DVM thesis under ethics number 5267.

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